Lean Construction Teaching Module: Push/Pull Planning

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The Construction Management Department at California Polytechnic University at San Luis Obispo has taken interests into the topics of Lean Construction to be a part of its curriculum. Lean Construction is a methodology in the built environment that tries to establish a leaner and more efficient work place in the industry. Within this broad spectrum of methodology, scheduling and more specifically, "push pull scheduling" is one of its many trademark applications. As the demand for more efficient projects rise, it is increasingly important for the next generation of construction students to be aware and educated with efficient skills. This experimental teaching module will dive into the material, strengths, weaknesses, results, and suggestions for faculty to be able to teach this module in their classrooms.

Key Words: Last Planner System, Push/Pull Planning, Sequencing, Scheduling, Planning

Introduction and Background

Breanne N. Forester's "*Implementing the Last Planner System into Cal Poly San Luis Obispo's Construction Management Curriculum*" is a great compliment to the Lean Construction Teaching Module. The lesson plan developed by Iroz has was done based off of recommendations by Forester's work about how to implement it with the help and development by Cal Poly's Jobsite Management class and assisted by its own faculty instructor Phil Barlow. Iroz also has extensive background with the field application of push pull scheduling due to his participation in many "Push Pull sessions" while working as an intern with Hathaway Dinwiddie Construction Company in the greater San Francisco, Bay Area region. While interning he was responsible for certain subcontractors and managing their work and sequencing critical path items. He also was responsible for directing entire sessions and ensuring smooth and efficient meetings that were beneficial to all that attended. This background and prior knowledge helped while designing the exercise and teaching module for the jobsite management class at Cal Poly.

Summary/Teaching Module Steps

Class Type

This teaching module is designed for a class of 15-25 upper division construction students. The structure of the jobsite management class that it is designed for has each student specified as a certain subcontractor. The student's role as the subcontractor varies from doing work from subcontract agreements, writing change orders, estimating their scope of work and creating a schedule for their work. All of these assignments represent field-required assignments based off the plans and specifications of a building on campus. The most important thing that the student is required to do for this exercise and activity is come prepared to class with a detailed schedule and understand their scope of work. On top of understanding their specific schedule, having a master schedule will help the students understand the activity and its backwards flow.

Pre-background

(1-hour work either outside or inside class) There are many good supplemental reads for students to get an introduction to Lean Scheduling. The first is an AGC article written by Debra Wood that talks about how to

implement Lean Scheduling into as well as a chapter out of the Lean Construction Institute textbook, which defines what exactly Lean Construction is and how it is used. These are included under the notes/others tab and are great resources for introducing lean scheduling, to assign to the class before the exercise.

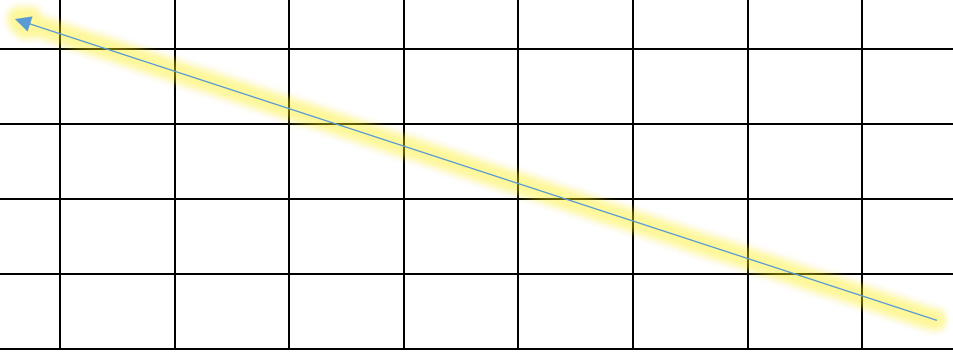
Lecture

(30-45 min of lecture done by faculty) The lecture was created by Iroz and is meant to be an given before the exercise and takes a stab at the more detailed structure and method behind lean scheduling and push pull planning. The lecture discusses what Lean Scheduling is; and its advantages when done correctly. Then it moves on to the Lean Construction Institute Industry (LCI) standard of lean construction. The finally moves into how push pull planning works, how it is used in the industry, and how we will be using it in the exercise. The PowerPoint used in the experimental lectures is under the Presentation tab.

Exercise/Activity

(1-2 hour engaging activity) The push pull activity is the most beneficial part of this project and required the most design and adjusting. As recommended by Forester in her paper, this activity works best in a class such as jobsite management where all the students are specified subcontractors. As mentioned above it is critical that the students have attempted to fully understand their scope of work and have created a detailed schedule. It would be beneficial for the students to recommend they try to think of sequencing and assembly orders. Before class, the person leading the exercise and lecture should set up a board that similar to the chart shown below.

Area	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9
Substructure									
Superstructure									
Skin									
Interior Finish work									
Exterior Finish Work									



At this point, the instructor should explain the process of Lean Scheduling and fact that the group will be scheduling "backwards." For example, the first items to discuss would be roofing and the last would be foundations and grading. The highlighted arrow shows the direction the activity should be moving. Individually call up every subcontractor and encourage the class to stay engaged by asking who should be next. It is critical that the instructor also stay involved and understands the process of how to sequence construction of the building. There will be many times as the instructor that you will have to correct durations or sequences. The instructor should not correct too many durations because once the entire project is sequenced it is recommended that you regroup the class and break students up into smaller group i.e. subcontractors who were all under substructure or interior finishes and ask them to attempt to cut durations in places where there is potential overlap and sandbagging. Once they create new durations and shorten all the major categories it is recommended that the instructor shows on the board what the new durations are and what the new durations of the sub categories and then also compare it to the master schedule and see if can be done in less time. This will show the students exactly what we were doing, and how effective lean scheduling is at cutting out the fat and fluff in a construction schedule.

Deliverables

The deliverables required for a successful activity and lesson plan is to first have the right type of classroom environment or create a similar atmosphere where each student is required to be the expert for a specific aspect of a project, whatever it may be. Second, assign reading material as supplemental work to help create a better lecture and discussion about Lean Scheduling. Third, there is a separate document for the instructions of the exercise attached in the notes/others tab, that outlines the deliverables for the students that day. Lastly being prepared with a plan for the activity, which includes having a poster board or place to do the activity and place sticky notes (white board). Then ensuring that the students come prepared with their individual schedule and have access to a master schedule for the entire project on hand.

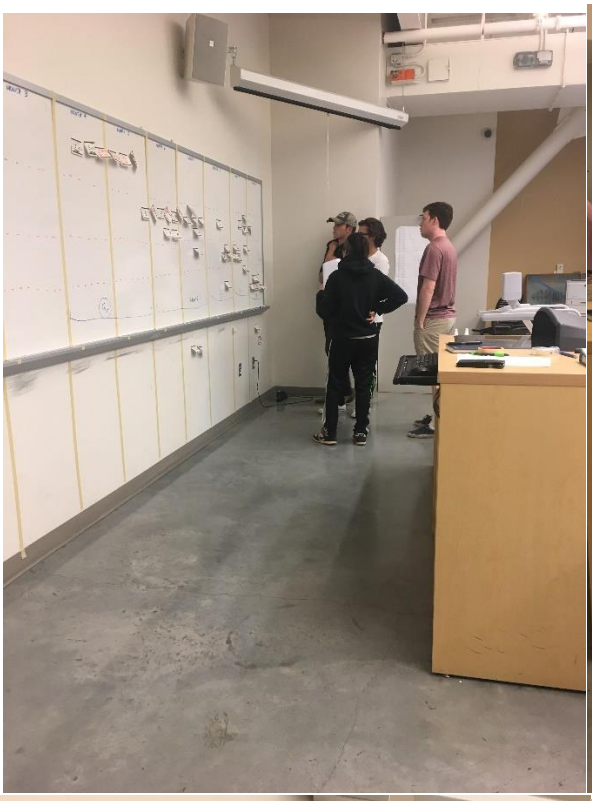
Conclusion/Lessons Learned

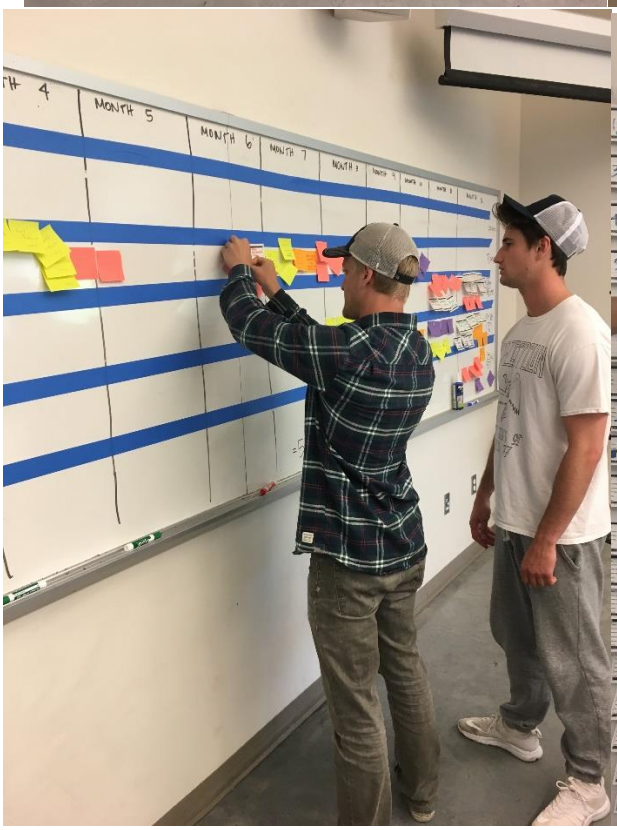
With a good understanding of the subject matter, it should not be hard to present a good lecture and have an educated discussion with the class. The most difficult part is being able to run an effective activity. Iroz had prior experience running a meeting and watching professionals run sessions. This helped with understanding what a good session looks like and how to keep subcontractors or in this case, students involved while not wasting their valuable time. The lessons learned through these experimental activities was to ask the students questions, and after the students are done working through their specific sequences to have them explain to the rest of the class what was going on. It is hard to keep all 25 students engaged while there are only one or two students working through a certain sequence. Asking the students to come prepared is also one of the most important requirements for a successful activity. Once the activity is over and we have found the new durations it is important to drive home the point that the goal of the exercise is to eliminate the unnecessary durations in a project. As well as a great tool for general contractors to use to get subcontractors to commit to durations, because they were the one agreeing and creating the schedule. This is another effective tool for the students to stay engaged. The students appeared to gain more interest in the exercise when they broke off into their smaller groups and tried to re-sequence their scope with other students. In conclusion, students and faculty at Cal Poly, San Luis Obispo in the Construction Management Department found the exercise and activity to be a useful learning tool. This teaching module helped students understand the importance of a good schedule, how lean scheduling can effectively reduce the unnecessary float in a schedule, while increasing productivity through detailed planning and buy-in from subcontractors. Lean Scheduling and Push Pull planning is a tool that is increasingly used throughout the construction industry and this exercise helps students gain a better understanding of how it is used.

References:

Forester, Breanne N. *Implementing the Last Planner System into Cal Poly San Luis Obispo's Construction Management Curriculum,* June 2016.

Pictures of Session

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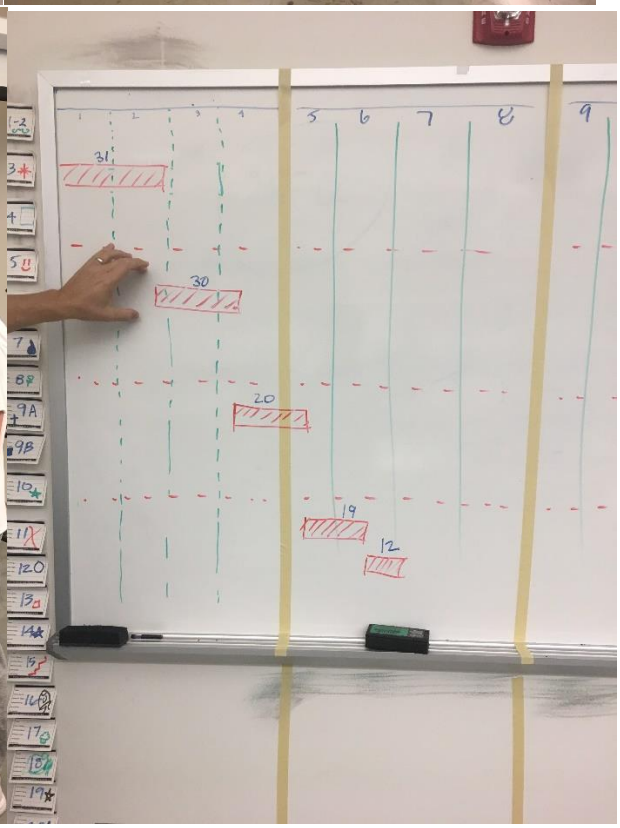
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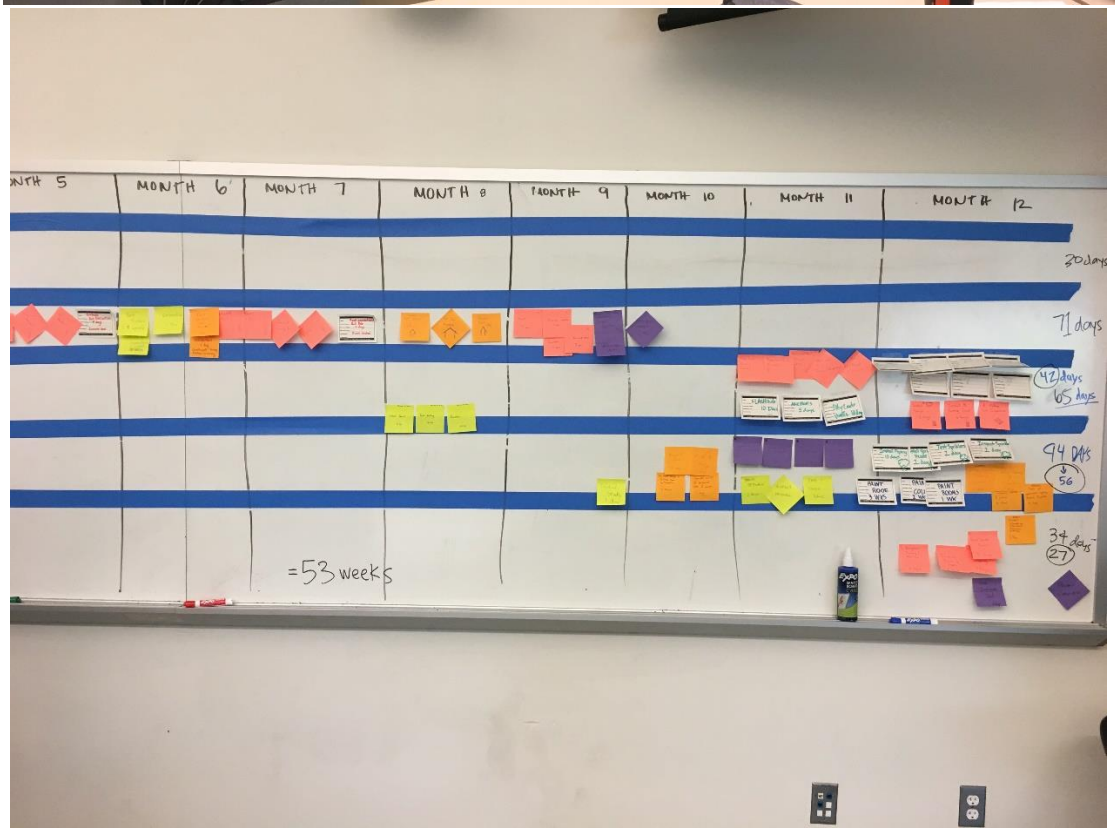
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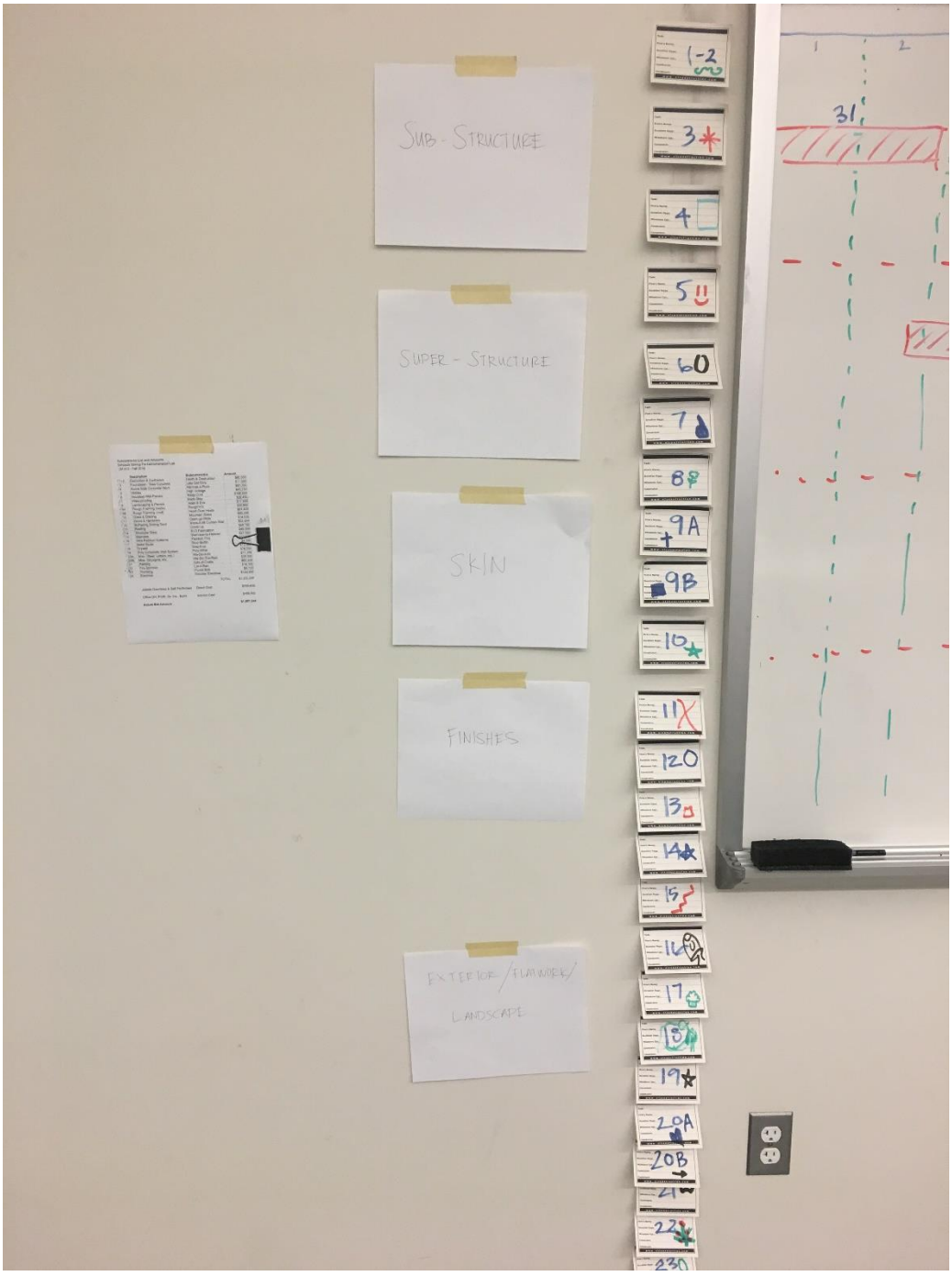
SUB - STRUCTURE
SUPER - STRUCTURE
SKIN
FINISHES
EXTERIOR / FLATWORK/
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