SOCIAL ASPECTS RELATED TO LBMS IMPLEMENTATION – A CASE STUDY

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ABSTRACT

LBMS adoption in California is steadily increasing. Several hospital case studies have been reported earlier but they have mainly focused on numerical measures related to LBMS. The previous research has highlighted the need to better understand the social aspects related to implementation. The case study reported in this paper presented a unique opportunity to develop social processes because the owner was involved from the beginning and was prepared to change their standard process.

The project goals included using a model-based cost plan to inform the schedule with quantities and cost per location, using LBMS to plan efficient labor flow and control production, as well as running pull planning sessions with subcontractors to collect input from those closest to the work. The challenges included creating integrated deliverables quickly and keeping them up-to-date with the evolving design, training the extended project team and helping the team resist the urge to fall back to traditional behaviors during crunch points. It was crucial to understand the role traditional CPM tools play in a project and determining how these tools should interact with the LBMS schedule.

To facilitate training, research was performed to understand and document why superintendents and subcontractors behave as they do on traditional projects and the changes required from both roles in order for the new systems to work.

KEYWORDS

LBMS, implementation

INTRODUCTION

The Location Based Management System (LBMS) is an alternative way to plan, schedule and control projects. It is the latest generation of location-based techniques starting from Line-of-Balance (Lumsden 1968) which was limited to exactly repetitive work. The next step in development was the flowline technique (Mohr 1979) which introduced locations on the vertical axis rather than work quantity, and thus allowed non-repetitive work. Other related techniques include integration of line-of-balance and CPM by Arditi et al. (2002) and RepCon (Russell and Wong 1993) among many others. LBMS introduced a flexible location breakdown structure, layered CPM logic to automate the generation of logic and a production control system forecasting production rates and problems based on historical data (Kenley and Seppänen 2010). The focus of LBMS is on continuous flow of resources, completing locations in sequence and synchronizing the production rates of crews. On

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the controlling side the focus is on preventing interference by taking early control actions to alarms (Kenley and Seppänen 2010). Several case studies of LBMS implementations have been previously reported (Seppänen and Aalto 2005, Seppänen 2009, Kenley and Seppänen 2010, Kala et al. 2012, Evinger et al. 2013, Seppänen et al. 2013, Seppänen et al. 2014). The focus of the previously reported studies was primarily to present quantitative results of the benefits of LBMS.

Although social aspects have been found to be critical in implementation (Seppänen 2009, Kala et al. 2012) the previously presented case studies have not focused on those. Some theoretical work has previously been done on the combination of the Last Planner System and LBMS (Seppänen et al. 2010). No implementations of that approach have so far been reported although several implementations are ongoing.

The key to understanding the social aspects of implementation is to understand the current behaviour of key stakeholders in LBMS implementation: the subcontractors and superintendents. LBMS theory details the desired behaviors and the expected benefits if those behaviors are implemented. If current behaviors and the motivations behind them are well understood, it is possible to re-train the stakeholders and start moving them towards the desired end-state. Some previous work has been done on subcontractor behaviors. Sacks (2004) researched subcontractor resource allocation decision making. Subcontractors try to maximize their resource utilization and profitability over multiple projects. Reliable projects motivate subcontractors to allocate more resources (Sacks 2004). Resource allocation has been seen as a game theoretical problem, where the general contractor can require too much, too little or exactly the right amount of resources, and the subcontractors can allocate too much, too little, or exactly the right amount of resources. If production is unreliable, the general contractor is motivated to require too many resources, and the subcontractors are motivated to supply too few resources (Sacks and Harel 2006).

The goal of this research was to better understand the traditional behaviors and their causes and develop a solid understanding of the current situation to be able to compare and contrast the intended behaviors of LBMS versus traditional work management.

CASE PROJECT OVERVIEW

The case project is a 255,000 sqft (23,690 m2), seven story office building in South San Francisco. Webcor Builders, a large general contractor operating mainly in the West Coast region of the United States, is the prime contractor. The contract type is Highly Collaborative Project Delivery, which has many similarities to an IPD project minus the three party agreement. Working in a big room, including performance incentives in most contracts, and behaving collaboratively were core traits used to select project partners. BIM enabled processes were another core component with BIM used in quality, cost and schedule management. Schedule management included the usage of LBMS informed by quantities per location from the model driven cost plan. The project is in the early stages of construction at the time of this writing.

The owner for this project has a project controls group, which includes professional schedulers. They have a well-defined process for the review and approval of project schedules enforced by the project contract. The project scheduler and her department manager along with other project controls personnel attended

LBMS training and worked closely with Webcor's team to modify their processes in a way that would allow LBMS while still achieving their corporate risk and cost management goals. The project team would not have been able to effectively use LBMS without their participation and willingness to modify their processes. The conclusion formed by the extended project team was that milestones could be made to match between CPM and LBMS. However, preferential logic to maintain continuous flow in LBMS was deemed too hard to mimic in CPM. Detailed tasks of LBMS must fit within the milestone boundaries, but the start and finish dates do not need to match. LBMS is used to plan and control construction activities and the CPM schedule is updated according to a set of rules for reporting purposes. This approach complies with the owner's reporting requirements and allows the team to use LBMS to plan efficient work flow and utilize production control.

METHODS

The traditional behaviors for both superintendents and subcontractors were validated in meetings with six superintendents and their assistants, with twenty five subcontractors, and with three claims experts or professional schedulers. Validation is still in process with additional representatives of each role and with new roles being involved in validation. All participants are either employees of Webcor Builders or work on projects where Webcor Builders is the general contractor.

TRADITIONAL BEHAVIORS VERSUS LBMS BEHAVIORS

The results of the subcontractor and superintendent meetings made it very clear why previous attempts to implement LBMS properly had challenges. Both superintendents and subcontractors have developed a way of working that best suits their specific interests while defending against the interests of the other party, as hypothesized by Sacks and Harel (2006) in their game-theoretical paper. Each party has an optimized process based on the management tools they have available and their expectations of the degree of cooperation they will receive from the other party. LBMS was previously presented as a series of improvements that would help each party be more efficient. When viewed from the context of the current situation, changes in behavior unbalance the system and seem to require one party to be penalized to benefit the other. In fact, both parties can benefit from changing their behaviors, but only if both parties make changes at the same time.

TRADITIONAL SUBCONTRACTOR BEHAVIORS

The primary interest of a subcontractor is to maximize cash flow across their entire set of projects. In California, there are differences between union and non-union subcontractors which need to be understood to comprehend all the variables related to subcontractor decision making. Non-union subcontractors have less flexibility in managing their labor pool than do union subcontractors. The full labor pool must be utilized nearly all of the time with limited ability to temporarily lay off workers without pay and ensure they will remain available when work is available. Additionally, non-union labor has a more variable skill level, which creates increased difficulty and expense in hiring and training programs. This situation results in non-union subcontractors having a strong desire to maintain a high level of billable resource usage.

Union subcontractors have more flexibility, but less than many people believe. A common misunderstanding encountered by the LMBS deployment team has been the belief that union subcontractors do not need to maintain a high degree of resource usage as they simply release workers whenever no work is available and call the union hall whenever resources are required. Based on subcontractor interviews, in reality, union subcontractors have three levels of resources. The first level is the management layer that is typically composed of full-time, salaried workers. The second level is a core group of union labor that is familiar with the company's processes. Although union workers have a more standardized level of trade skills, there are unique practices at individual subcontractors that require training and experience. Additionally, these workers have gained the trust of the management layer. Both factors create a strong need to maintain a high degree of resource usage for both the management layer and the core group of union workers. The third layer represents workers hired from the union hall and laid off when work is not available. The need to maintain these workers is less unless the local market is busy with construction work, which may result in the hall labor being unavailable when required. Union subcontractors do have slightly more flexibility in maintaining a high level of resource usage, but there is still a strong desire to minimize fluctuations in the pool of workers.

Subcontractor behaviors can be categorized into three main groups which will be elaborated in the sections below:

- Starting work and ramping up of resources
- Developing excuse backlogs for potential claims
- Maximizing cash flow

Starting Work and Ramping Up Resources

Subcontractors prefer to start work on a project at a time that is convenient for the enterprise, which can include starts both earlier and later than the project superintendent prefers. Earlier starts can be driven from a ramp down on another project or the availability of resources in a tight labor market because projects from other companies have ramped down. Late starts are desired when work on other projects is either running late creating delivery problems or when other projects have a proven ability to provide good cash flow.

There is a general preference to start work slowly to minimize costs while identifying problems and learning the project. Subcontractors prefer to send a small number of resources to learn the project, identify problems which could block efficient workflow and prove whether work can be efficiently performed. Subcontractors prefer to increase project resources only when the initial crew has proven work can be efficiently performed.

There are also cases where subcontractors are ready to ramp up even if efficiency has not been proven. This happens when other work is slow. Subcontractors are able to gamble on work efficiency to maintain resource usage levels if other work is not available due to the lack of other projects or unexpected problems on other projects.

Excuse Backlog and Claims

Subcontractors start building an "excuse backlog" as early as possible. They look for problems that can be used as an excuse for delay and store them until needed. When the subcontractor creates a problem, the previous delay is brought up as an offer to 'call it even'. If the excuse backlog grows larger than the subcontractor requires, a claims process may be initiated to convert some of the backlog into cash.

The probability of a claim is increased when the targeted profitability is at risk. Subcontractors will more aggressively use the excuse backlog or look for additional problems when their targeted profit is damaged due to delays or poor estimating. Subcontractors may even become more aggressive when problems from other projects damage overall profitability and/or cash flow.

Maximize Cash Flow

Subcontractor preference is to invoice early to establish a positive cash position on the project. Many owners have developed a standard response by delaying payment, which creates an increased desire to front load work to accommodate the delayed payments. Note that in this case, front loading refers to billing for more work than has actually been put in place by transferring increased value to design, fabrication, material procurement or mobilization charges, which is different than the following examples of increasing actual work put in place.

To optimize cash flow, subcontractors like to complete the easiest and most valuable work in multiple locations first. To achieve this goal, multiple crews can simultaneously start multiple locations. Although this behavior does legitimately increase the value of work put in place, it results in multiple unfinished locations, which prevents the downstream trades from starting and finishing these locations. This behavior creates a ripple effect causing cascading delays to the project and greatly decreasing the ability of downstream subcontractors to work efficiently. As successive subcontractors deal with incomplete predecessor work and add their own desire to complete easy work in multiple locations, labor efficiency quickly devolves. Theoretically, this behavior would not impact the overall project schedule as long as the behavior was not deployed in locations that were on the critical or near critical path. In practice, the critical path is often impacted when overall efficiency continues to devolve. Inefficient labor always increases costs. As these problems are standard on projects, the inefficiency is priced into the work to some degree. It also results in a large number of expensive claims. As the practice is so common, subcontractors know they can always resort to claims to recover from problems.

Subcontractors tend to complete repetitive work in all available locations before switching activities. This behavior is strongly related to the previous topic. Once a crew starts performing a particular activity, they can increase efficiency by continuing with the activity in other locations rather than switching to the next activity in the previous location. On the surface, this behavior seems efficient until the cascading delays it creates are taken into consideration.

Summary

In general, subcontractor behavior can be summarized by a legitimate desire to focus resources on profitable and predictable projects. However, fulfilling this desire often comes at the expense of other subcontractor's productivity and damages the project as a whole. This situation is created by focusing improvement efforts only on aspects the subcontractor can directly control and not considering the possibility of unified improvement efforts by all project participants.

The behavior of storing excuses until needed is common to all human interactions. The behavior of resorting to claims is natural in an industry that so often selects the lowest bidder when the plan is based on an efficiency that is rarely achieved and claims can so easily be justified. Considering one subcontractor alone, the behavior is well optimized for the environment. Only by changing the environment where the subcontractors can trust that all their peers and the general contractor will focus on project efficiency first and by creating a compensation model that rewards all parties for focusing on project efficiency can the situation be changed. This collaborative, lean situation will be explored in the following sections.

Note that not all subcontractors exhibit all of these behaviors as a standard practice. Some subcontractors do not have a centralized command and control management infrastructure to so thoroughly optimize for enterprise cash flow. Where the subcontractor's project managers and superintendents have more autonomy, they tend to mix these behaviors with the behaviors ascribed to general contractor superintendents as explained in the next section.

TRADITIONAL SUPERINTENDENT BEHAVIORS

The primary interest of a superintendent is to minimize the risk on the one project they are responsible for managing. They combine a focus on high-level planning and a focus on problems as they arrive. Their actions are based on a combination of intuition and experience fed by direct observation with limited trust in planning tools. In order to minimize project risk, superintendents have adopted the following tactics:

- Start as soon as possible with a large labor force
- Focus controlling on dates
- Use intuition and experience
- Pretend to be omniscient and omnipotent

Start as soon as possible with a Large Labor Force

Superintendents prefer for subcontractors to start work on the first day predecessors could reasonably be expected to finish even if the early start is likely to prevent continuous labor flow and to start with as many resources as possible. Superintendents prefer for subcontractors to start with a large labor force and only reduce resources when it is proven they are not required.

Superintendents would prefer for subcontractors to find other locations they can start or switch to workable backlog activities or stand around and wait if the current location cannot be completed or the next location is not ready. Superintendents know they are not likely to get all of the same resources back when desired. Either they come later than desired or new resources arrive that must go through the learning curve again.

Focus on Dates

Superintendents are focused on making dates, not on achieving efficient production. Great superintendents do consider efficiency in their plans but dates are their must achieve mandate. Productivity is a secondary consideration that is the primary responsibility of the subcontractors. Superintendents focus the majority of their time on activities that are critical or near critical with less focus on making sure other activities are moving along. Their primary interest in non-critical activities is maintaining a list of available work that subcontractors can perform if their critical work is interrupted, which helps prevent the subcontractors from leaving the site.

Intuition and Experience

Superintendents make most decisions based on intuition fed by experience. They rarely have all the data required to make a fully informed decision. In many cases, this behavior has become a preference. At the beginning of their career, when they lacked experience, they almost certainly would have preferred to have good data to inform their decision making, but it was rarely available. Over time, they gained experience and could make a reasonable decision based on intuition with increasing frequency. As their ability to make intuitive decisions increased, they developed pride in their intuition and experience. Superintendents with decades of experience would, in many cases, not bother with hard data now even if it was available because an informed process would not showcase their abilities and thus might diminish their perceived value.

Superintendents do not place a lot of faith in planning tools. They understand and trust the basic date calculations used in CPM for high-level planning, but they do not look to planning tools to make day to day decisions. The planning tools, to a degree, are only used as a reporting tool to convey approximately what has already occurred or by other people to assess fault and damages for problems that have occurred.

Decision making is based on direct observations. Superintendents place the most faith in the direct observation of the state of the site. Frequent site walks are used to collect information and support day to day decision making. Reactionary focus on addressing current problems consumes a majority of the available time. Due to the lack of faith in planning tools and the focus on direct observations, a lot of time is spent addressing problems that have already or soon will occur. A vicious cycle sets in as soon as current problems overwhelm available time leaving little time left to focus on avoiding future problems.

A false sense of short-term pessimism and long-term optimism is common due to the focus on current problems and the lack of time spent considering possible future problems. Some superintendents are only half-jokingly pessimistic about the current state and the future state as they have often been trapped in the cycle of spending all available time focusing on current problems leading to a continuous stream of new problems. Those that are pessimistic about the short-term and the long-term look for reasons to implement acceleration charges and actions early.

Omniscience and Omnipotence

Superintendents must convey near omniscience and omnipotence to the owner. Owners perceive that the superintendent has the most influence over the project during construction. The owner wants a superintendent that exudes confidence and has complete control over the project. Owners want to be able to make decisions immediately during meetings. They do not want to hear frequent requests for time to research the issues and collect input from the affected trades. Superintendents have learned to pretend they hold the entire project with all the details in their heads, which in reality is impossible for almost everyone on larger projects. Superintendents have had to convey confidence so often, they have adopted it as a constant aspect of their persona and many have falsely come to believe they actually do hold knowledge of all project aspects. Many owners and other project team members have also come to believe the same.

Summary

In general, superintendent behavior can be characterized by a focus on mitigating risks on a single project with processes based on input from direct observation and actions driven by intuition and experience. A large percentage of time is spent on reactionary behavior preventing a focus on future problem prevention. An excuse backlog is maintained to justify acceleration charges, which allows the superintendent to be more focused on achieving the schedule than the budget.

It is important to note that there are superintendents that are more data oriented and do focus more time on problem avoidance. Behaviors are not binary and all superintendents occupy different points on a continuum between focusing on project risk versus labor flow, fighting today's problems versus preventing future problems, and using data versus intuition.

IMPACT OF BOTH PARTIES BEHAVING TRADITIONALLY

With all parties following traditional behaviors, superintendents attempt to force subcontractors to bring a larger number of resources to the site earlier than is required. Subcontractors attempt to start when required with a very small crew until it is proven that production can be efficient. Subcontractors then attempt to maximize billings by working on the easiest activities in a large number of locations. Downstream subcontractors cannot complete work in locations where their predecessors are partially complete. Superintendents look for available work these subcontractors can perform in locations other in which they were scheduled to work so they can stay busy rather than leave the site. These subcontractors interfere with other trades that were scheduled to work in those locations. Subcontractors respond by reducing labor and partially complete work wherever possible to keep the superintendent happy.

As more subcontractors start, the situation rapidly becomes increasingly complicated. Superintendents are forced into a mode of constant firefighting and frequent efforts to keep subcontractors onsite. Resource levels fluctuate frequently as subcontractors bounce people between sites in attempts to increase enterprise wide billings. During upswings in resource levels, new resources are brought onsite, which have low efficiency as they have to repeat the learning curve. Site management becomes increasingly complicated and chaotic with labor efficiency continuing to diminish. As the project completion date begins to slip, reasons are found to justify acceleration charges and subcontractors begin working longer hours, more shifts, more days, or with more resources. As increasing inefficiency begins to erode general contractor and/or subcontractor profitability, reasons are found to make claims requesting more money. Projects are often, but not always, completed on time, but at higher cost to the owner and with less profitability than planned for the general contractor and the subcontractors.

DESIRED LBMS SUBCONTRACTOR BEHAVIORS

In the planning phase, subcontractors in LBMS projects should participate collaboratively in planning and optimizing the schedule. This participation includes agreeing to a common Location Breakdown Structure, pull planning to get a list of tasks and their relationships and providing quantities and labor consumption rates for each identified task (Seppänen et al. 2010). These data are the starting data for schedule optimization. Schedule optimization means identifying the bottleneck tasks and collaboratively working to find ways to increase their production rate. When a bottleneck cannot be accelerated, the other tasks are aligned to the production rate of the bottleneck (Kenley & Seppänen 2010). This approach is similar to takt time planning (e.g. Frandson et al. 2013), except each subcontractor is planned to have continuous work and work with optimal crews. These pull planning sessions should result in a commitment to the planned production rate.

During construction, subcontractors are expected to self-report their actual progress by location in daily reports. In addition to standard CPM reporting requirements, information on the percentage of work completed, actual resources on site and any suspensions of work is required. This information is used to calculate actual resource consumption rates and production forecasts. If the forecasts indicate interference with another trade, subcontractors should participate in planning control actions to prevent production problems (Kenley & Seppänen 2010).

Operationally, subcontractors are expected to complete one location completely prior to moving to the next scheduled location. Any make-ready work, such as coordination, reviewing drawings and material deliveries, should be prioritized based on the planned sequence of locations. Planned sequence should be followed with planned production rate. Optimally the same crew would work continuously from one location to the next, maximizing predictability and any learning benefits. The ultimate goal is to perform work as productively as possible without interfering with other subcontractors (and without interference from others) (Kenley & Seppänen 2010)

DESIRED LBMS SUPERINTENDENT BEHAVIORS

The superintendent is the critical role for LBMS implementations. A good LBMS implementation requires data-driven decisions for starting new tasks and for taking control actions regarding currently ongoing tasks. Each mobilization and demobilization should be analyzed for its impacts on production.

Starting new crews and tasks are critical decisions in LBMS. In general, according to pull control principles, new work should be started only if the project is ready to accommodate additional resources. If the predecessor is delayed, a new task should not be started just because it has been planned to start in the phase schedule. Starting tasks too early can lead to interference which can slow down the work of the predecessor because of the space required for materials and location congestion (Seppänen 2009).

With ongoing tasks, the focus should be on frictionless, continuous production. This requires proactive control by the superintendent. Any potential issues need to be found and solved ahead of production. A good rule of thumb is to keep two or three locations clear ahead of each crew. This make-ready work relates to information, materials, and equipment but also critically to the production rates of predecessors. Production rates should be actively monitored and any deviation which results in a production alarm should trigger an immediate control action collaboratively with the subcontractor. Although it is possible to calculate the number of crews required based on actual consumption rates, the primary focus should be on working with the subcontractor to improve productivity because any increase in resources is likely to decrease productivity (Seppänen et al2014).

Other important superintendent behaviors include not allowing subcontractors to interfere with each other, for example by delivering materials too early or not cleaning locations when completed. Subcontractors should own their location when working there and leave a clean, empty location to the succeeding subcontractor. Work should flow in a logical sequence to minimize confusion. The superintendent is also responsible for maintaining a work backlog for each subcontractor so that the resources are not forced to demobilize if continuous flow is disturbed in their main production tasks.

Impact of Both Parties Implementing Desired LBMS Behaviors

Several benefits of LBMS have been reported previously in projects where the behaviors were not completely changed. Seppänen (2009) reported an opportunity to compress project durations by 10% by eliminating cascading delays. Evinger et al. (2013) compared CPM to LBMS using different floors of the same project where some floors were managed by a superintendent closer to LBMS behaviors and other floors managed using traditional behaviors. They found that productivity on "LBMS floors" was 18% in favor of LBMS and the average production rate difference on comparable tasks was 10%. Related to control actions, Seppänen et al. (2014) reported that control actions were able to prevent production alarms from turning into problems 50% of the time and the control actions resulted in an average increase of 37% in production rates. However, many of the alarms did not trigger a reaction or triggered an incorrect reaction which can probably be attributed to traditional behaviors driving LBMS implementation.

The benefits associated with LBMS implementation in a project where behaviors were completely changed can be expected to be much higher. The reliability of project schedules should increase, fewer production problems should materialize and the productivity should improve (more than the previously achieved 18%). It is difficult to compress a schedule once a baseline has been defined because various stakeholders plan their operations using those dates, but in any new projects increased reliability can lead to increased production rates and a decreased need for buffers and thus achieve duration compression. The opportunity has been previously been identified as 10% for plan optimization and 10% for production control (Seppänen 2009).

DISCUSSION

We have used two party language to simplify the description of the situation, but in fact the current systems are designed as much to protect the interests of one subcontractor from other subcontractors as to protect the subcontractor from the superintendent. The benefits of LBMS can only be fully achieved in the context of the superintendent and all subcontractors simultaneously changing their behaviors. The reaction from the superintendent and subcontractors on the case project has been more positive since we were able to present the benefits and problems inherit in the current system by comparing and contrasting the new behaviors and benefits associated with LBMS.

Trust requires understanding the other party's motives. Having reviewed each party's current interests and common behaviors with key project team members, all parties are more enthusiastic that the new approach could work. All parties are now looking for validation that the other parties will behave according to the recommended behavior. Having documented a list of current, bad behaviors and the desired, new behaviors, each team member knows what to watch for and is more confident in calling attention to bad behavior. Peer pressure may be more effective in driving change than many of the other benefits that do not directly and personally affect the project team members. We believe having a collaborative contract type is not enough to create trust and successfully implement LMBS or any other Lean approaches. With trust we believe any project can benefit from the system regardless of contract type. However, we believe projects with collaborative contract types benefit the most.

It is important to note that superintendents rarely agree that they personally exhibit all the traditional behaviors described in the following sections, but they acknowledge that other superintendents do. Subcontractors generally agree with all described behaviors both for themselves and for superintendents, but they also agree that some superintendents are much better are running labor efficient sites than others. The researchers' conclusion is that there is a greater range of behaviors for superintendents than there are for large subcontractors with enterprise level command and control. Changes in project design during construction occur frequently and is probably responsible for some of the short term focus exhibited by superintendents. Traditional planning techniques are laborious and dealing with frequent changes to long term plans have likely driven superintendents to focus more on the short term. Some superintendents realize that efficient labor flow is the best way to motivate subcontractors and consequently spend more time attempting to enable it. Smaller subcontractors have not yet been involved in the research.

The project is currently nearing the completion of the structure. An important future research topic is to follow the project to its conclusion and compare and contrast the achieved results with those reported earlier. Was education of the teams enough to change behavior and how did this influence the results in terms of production rates, productivity and total duration? Detailed quantitative metrics from the projects will be collected and qualitative results will be collected through direct observation, interviews of project stakeholders and a survey after the conclusion of each construction phase.

CONCLUSIONS

Early attempts to implement LBMS were met with resistance as both subcontractors and superintendents did not trust the other party to behave correctly nor did subcontractors trust each other. Educating all parties that they each have a system designed to protect their own interests and guard against the conflicting interests of the other parties helped each one to develop a deeper understanding and trust in the others. Once this state was achieved, all parties were more open to learning how a different approach could work. Educating all parties on how the new system and a new set of behaviors could better protect their own interests and improve the project as a whole increased their willingness to seriously attempt to implement the new system.

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