

CHALMERS



Implementing Last Planner on Construction Sites

Foremen and Superintendents' Experiences of a Lean Implementation

Bachelor's Thesis in the Building and Civil Engineering Program

MARTIN HALLMAN

Department of Civil and Environmental Engineering

Division of Construction Management

CHALMERS UNIVERSITY OF TECHNOLOGY

Göteborg, Sweden 2013

Bachelor's Thesis 2013:144

BACHELOR'S THESIS 2013:144

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Examensarbete inom högskoleingenjörprogrammet Byggingenjör

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Institutionen för bygg- och miljöteknik

Avdelningen för Construction Management

Chalmers tekniska högskola

SAMMANFATTNING

"Lean Construction Management" är en förbättringssystem och är numera ett etablerat begrepp inom byggindustrin och myntades så tidigt som 1993 (Koskela, *Theory-based* 33). Som namnet antyder är tanken bakom Lean att kontinuerligt förbättra tillvaron och detta genom att minska slöseri med fokus på att skapa ett jämnt produktionsflöde. Det verkar som om initial respons ofta är negativ till systemet och att företag därför tvekar inför alternativet att införa detta system och det är orsaken till denna uppsats. Studien genomfördes så att företag och personer i byggbranchen kan förstå hur Lean eller liknande förbättringssystem kan införas på ett mer effektivt och smidigt sätt och därav lära ifrån andras misstag och framgångar.

Fem platschefer och en arbetsledare, alla inom olika företag, som har introducerat Lean och främst konceptet Last Planner System i Chicago regionen intervjuades. Last Planner System är ett planeringssystem som finns till för att förenkla planering, utförande och kontinuerlig förbättring. Under införandet av Lean Construction Management uppstod motstånd huvudsakligen på grund utav underentreprenörer som gör det faktiska arbetet på arbetsplatsen. Av denna anledning är den största utmaningen att förstå underentreprenörers behov och finna lösningar till att införa förbättringssystem på ett sätt som tydligt gynnar dem. Utifrån denna studie var fyra teman konsekvent återkommande; att ha en ledargestalt som kände till Lean väl och fullt ut ville införa konceptet, att som ett första steg införa "Last Planner System" som gav gott resultat på samarbete, att införa konkreta och övergripig träning för underentreprenörer och slutligen att anställa arbetare som vet vad de gör och bryr sig om vad de gör. Slutsatsen var därför att införandet av Lean kommer att orsaka motstånd som kan vändas till framgång genom att engagera underentreprenörerna.

Nyckelord: Lean, construction management, intervju, Last Planner System

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ABSTRACT

Lean Construction Management is a Continuous Improvement System that has been around in the construction business since 1993 (Koskela, *Theory-based* 33), but initial resistance seems to have prevented companies from introducing the system. This research was performed so that Lean or other Continuous Improvement Systems can be implemented in a more effective and smooth way so that future implementing companies and people can learn from past mistakes and successes.

Five construction superintendents and one foreman at different companies were interviewed. Each one of them has implemented Lean and foremost the Last Planner System in the Chicago region. The Last Planner System is a product planning system with the purpose to produce a better flow of planning, production, and continuous improvement. Existing resistance of Lean Construction Management mainly originated from subcontractors and foremen who did the actual field work. Therefore, the greatest challenge to overcome is to understand their needs and wants. Consistent themes to overcome resistance were; having a worker in a leader position that knows the system well and is passionate about the implementation of it, using the Last Planner System as a first gradual step into becoming Lean mostly because of its benefits in improved collaboration, investing in conceptual training for foremen, and hiring people who know and care about what they are doing. The conclusion is that the implementation of Lean will create resistance, but by simply engaging foremen in the field the implementation will be successful.

Key words: Lean, construction management, interview, Last Planner System

Table of Contents

SAMMANFATTNING	I
ABSTRACT	II
TABLE OF CONTENTS	III
ACKNOWLEDGEMENTS	VII
NOTIFICATIONS	VIII
1 INTRODUCTION TO THE STUDY	1
1.1 Background	1
1.2 Objective	2
1.3 Methodology	3
1.4 Limitations	4
1.5 Anticipated Benefits	4
2 LAST PLANNER SYSTEM	5
2.1 Lean Production	5
2.2 Lean Construction Management	6
2.3 Last Planner	6
Master Scheduling	7
Phase Pull Planning	7
Make Work Ready Planning	7
Weekly Work Planning	7
Learning	8
3 METHODOLOGY	9
3.1 Building Theory from Case Study Research	9
3.2 Selection of Cases	10
3.3 Interviews	11

3.4	Analysis	11
	Within-case Analysis	11
	Cross-pattern Search	11
4	RESULT	13
4.1	Baseline Assessment	13
4.2	Major Areas of Emphases	13
	Organizational introduction of LCM	14
	Subcontractors initial reaction	14
	The champion's influence	15
	LPS's effect on collaboration	15
	Additional advice to implement LCM well	16
4.3	Pair Analysis	17
	Co-workers of the same company #1	17
	Co-workers of the same company #2	19
	Foremen during implementation of LCM	20
	Large vs. Small company employees	22
	Largest age gap	24
	Short vs. long implementation of LCM	26
5	DISCUSSION	28
5.1	Champions	28
5.2	Pull Planning	29
5.3	Resistance	29
5.4	Training	30
5.5	Advices from Interviewees	31
6	CONCLUSION	32
7	REFERENCES	34
	APPENDIX A	36

APPENDIX B	38
APPENDIX C	48
APPENDIX D	61
APPENDIX E	70
APPENDIX F	77
APPENDIX G	89

Acknowledgements

Firstly, I would like to express my gratitude towards my advisor Dr. Cindy Menches at Illinois Institute of Technology for her great support and ideas. She made it possible to schedule interviews, network with companies, and she gave valuable critique and information. Additionally, I would like to express my gratitude towards my advisor Dr. Per-Erik Josephson at Chalmers University of Technology who has been of great support and has given precise critique and guidance.

I would also like to thank all the participants in this study as well as their companies. The participants' passionate spirit, thoughtful answers, ideas, and comments have been highly valuable. Without them, this study would have been nothing but blank papers.

Lastly, I would like to express my thanks to Lauren Fueyo, who makes me better and supports me through everything.

Chicago, USA, November 2013

Martin Hallman

Notifications

Explanations

Foreman	Person responsible for the work on site of a specific trade
Superintendent	Person responsible for operation, control, and short-term schedules for all trades on site
MLA format	Modern Language Association format has been used to cite this thesis

Abbreviations

CIS	Continuous Improvement System
CM	Construction Management
HVAC	Heating, ventilation, and air conditioning
LCM	Lean Construction Management
LPS	Last Planner System
LCI	Lean Construction Institute
PPC	Percent of Plan Complete

Tables

Table 1	“Process of Building Theory from Case Study Research”
Table 2	Baseline Assessment of Interviewees B-G

1 Introduction to the Study

The chapter is an introduction to this study with brief explanations of why research was initiated, where inspiration was taken from, what the study intends to accomplish, and the limitations of the study.

1.1 Background

According to Gregory Howell, cofounder of Lean Construction Institute (LCI), there are principles, methods, and techniques in Production Management that have great potential in Construction Management (CM) (Howell *What 4*). However, already at the beginning of implementing Lean Construction Management (LCM), Lauri Koskela, who is a founding member of the International Group for Lean Construction, announced that:

The attitude to the new production philosophy in construction provides for a paradox: It contains a promise of tremendous possibilities for improvement and a solution of the chronic problems of construction; however, the interest from both practitioners and academicians has been at best lukewarm (Koskela, Application 64).

Dr. Cindy Menches, assistant professor at Illinois Institute of Technology, shared during one of her lectures that even now, LCM struggles to conquer new ground (Menches) and resistance builds up from a number of directions (Ballard and Koskela 14)(Winch 12-13).

One of the interviewees attested, even before this study was initiated, that LCM changed his life. He was part of a group of workers who resisted, but then went through a life changing experience as his company implemented the system. LCM is not growing fast within construction, which is surprising considering how passionate people are who implement LCM. Therefore, cases were selected according to the specification: “Construction superintendents and foremen who have implemented LCM after first resisting, but currently support the concept firmly.” However, the specification of interviewees did not always meet expectations. Hence, the original

idea of understanding how to overcome LCM resistance slightly changed into theory building: How can this research help companies and workers to implement Continuous Improvement Systems (CIS) like LCM? This decision was made on the basis of the Stanford professor Kathleen Eisenhardt's writing:

...although early identification of the research question and possible constructs is helpful, it is equally important to recognize that both are tentative in this type of research. Also, the research question may shift during the research... most importantly, theory-building research is begun as close as possible to the ideal of no theory under consideration and no hypotheses to test. Admittedly, it is impossible to achieve this ideal of a clean theoretical slate. Nonetheless, attempting to approach this ideal is important because preordained theoretical perspectives or propositions may bias and limit the findings (Eisenhardt 536)

The construction companies interviewed rarely pursued LCM in its full entirety, but the Last Planner System (LPS) was consistently mentioned as the most helpful concept. Again, the research had to take a different direction as LPS is not necessarily a LCM concept only. It is developed by Howell and Glenn Ballard, founders of LCI, but it is described as a "Production Planning System" which can be incorporated in any company and way of running projects ("*The last planner*", par. 1). Current LCM implementing superintendents and foremen have shared their stories of how LPS was, is, and can be implemented in hope that this study will provide practical help and ideas of how to implement LPS effectively, and thereby LCM or possibly other CIS.

1.2 Objective

The objective of this study is to give a view of how a LCM implementation transformed worker's experiences and organizations, what the companies did and what initial reactions were shared among workers. Additionally, the purpose of this thesis is to help companies, people in the construction business, and students in the academic world to understand what a smooth transition into the implementation of LCM or other CIS may look like. Through this case study, theories were conducted based on the experience of six construction superintendents and foremen, who have

implemented LCM and specifically LPS at their company. The broad questions that were discussed are:

- When initially exposed to LCM, what were the construction superintendents, foremen, and workers initial reaction?
- How did each company handle the transition of implementing LCM?
- At what point did the construction workers understand the benefits of LCM? And how?
- Is it possible that education and training play a role in how workers reacted to the implementation of LCM?
- And finally, what advice do these workers have after a LCM implementation?

1.3 Methodology

The method used to investigate the benefits and implications of a LCM implementation was six case studies involving on-site interviews. In all cases but one, the current work site was toured and planning sessions attended. Four construction companies were represented from the Chicago region, five superintendents and one foreman. Cases were selected according to the specification: “Construction superintendents and foremen that have implemented LCM after first resisting, but currently support the concept firmly.” This original idea eventually shifted into theory building around how to empower companies, workers, and students to understand what a smooth implementation of a CIS like LCM might look like. Multiple data collection methods were emphasized, two investigators used, first impression partly ignored, and literature compared to build internal validity. The Case Study format used followed Eisenhardt’s article on “Building Theories from Case Study Research”, which will be explained in greater detail in Chapter 3 – Methodology. Additionally, facts and numbers were collected from archives, mainly online sources such as scholarly articles, reports, literature, and websites provided by governmental and non-governmental organizations. Lastly, further education was attained through studying “Lean Construction and Control” at Illinois Institute of Technology in Chicago.

1.4 Limitations

Eisenhardt and Graebner suggest that 4-10 cases are studied to construct theories (27). This research is limited to six case studies containing the interviews of six individuals and analysis thereof. However, while this may only be the beginning of a larger process, this study contributes to the larger process of needing more CIS information and understanding, especially regarding smooth implementations using LPS. Furthermore, the analysis used to process data was time consuming, yet simple. It was divided into two steps and no more due to the fact that the study was performed by one student only.

1.5 Anticipated Benefits

The anticipated benefits of this study include, but are not limited to, helping companies, workers in construction, and students to understand how to implement CIS like LCM more effectively. Furthermore, I hope to offer tools for how to overcome initial resistance and strengthen inter-company communication and relations. This will be achieved by sharing perspectives from current superintendents and foremen and their experiences from introduction to full implementation of LPS and partly LCM.

2 Last Planner System

The following section provides an overview on the Last Planner System, its origin, and what it can accomplish when adapted.

2.1 Lean Production

The concept of Lean Production has been continuously evolving since the Toyoda Automatic Loom Works, the parent firm of Toyota Group, was established in 1926 (Liker 16). A combination of early ideas of Toyota and a study trip to Henry Ford's plants laid the foundation for the Toyota Production System (Liker 18), which has been known as Lean since 1990 (Womack et al. 12). The car manufacturer Henry Ford revolutionized the production process as he in 1913 standardized work tasks so that regularly made parts could be produced at a faster rate, termed "flow production" (*"A brief history of Lean"*, par. 1). Ford wrote in his book "Today and Tomorrow" about *"the importance of creating continuous material flow throughout the manufacturing process, standardizing processes, and eliminating waste"* (Ford). However, Ford did not fully practice what he preached (Liker 22). He emphasized batch production methods, which created batches of parts and products instead of continuous material flow (Howell, *What 2*). Toyota Group, inspired by Henry Ford, used Ford's original idea of continuous material flow and further developed it by creating their own "one-piece flow." Toyota wanted to master fluctuations of customer demand and deliver products immediately. They brought Ford's original ideas to life and shifted focus "from individual machines and their utilization, to the flow of the product through the total process" (*"A brief history of Lean"*, par. 6).

"One-piece flow" or "Continuous process flow" is just one out of 14 principles that are commonly used by Lean enterprises (Liker 36). However, Howell summarizes Lean production into four bullet points:

- "Identify and deliver value to the customer value: eliminate anything that does not add value.
- Organize production as a continuous flow.

- Perfect the product and create reliable flow through stopping the line, pulling inventory, and distributing information and decision making.
- Pursue perfection: Deliver on order a product meeting customer requirements with nothing in inventory.” (Howell, *What 3*)

2.2 Lean Construction Management

LCM, has been around since 1993 and aims to incorporate these four principles found in Lean Production (Koskela, *Theory-based* 33). These principles are not easy to implement since the practice of construction varies more than traditional manufacturing (Koskenvesa and Koskela 95). Koskela et al. describes LCM as a “way to design production systems to minimize waste of materials, time, and effort in order to generate the maximum possible amount of value” (*Foundations of Lean Construction*).

2.3 Last Planner

Lean creates endless opportunities and this exploration is only able to cover a portion of the full complexity that CIS are (Mossman 19). The four principles that encapsulate LCM are all incorporated in LPS and is therefore a crucial concept incorporated in LCM implementations. The construction companies interviewed rarely pursued LCM in its full entirety, but LPS was consistently mentioned as the most helpful concept.

Koskenvesa and Koskela explain the potential impact of LPS:

The Last Planner System endeavors to recreate the neat rectangular form of a task output, starting sharply, reaching the sustainable and stable output level immediately, maintaining it to the end, and thus finishing the task as planned, without any tail end (102).

LCI summarizes the LPS and its contribution in these five bullet points (“*The last planner*”, par. 1):

- Master Scheduling
- Phase "Pull" planning

- Make Work Ready Planning
- Weekly Work Planning
- Learning

Master Scheduling

As for any company, Lean or not Lean, the master schedule is first decided. Milestones are set and strategy chosen (Koskenvesa and Koskela 104) with the help of some key trades.

Phase Pull Planning

Pull Planning is a phase “carried out in collaboration between different teams and subcontractors” and it “ensures that the best order of tasks is determined, and thus the risk of unforeseen interference between tasks is diminished” (Koskenvesa and Koskela 104). Practically this means that a company brings their subcontractors and foremen (those who are directly responsible for supervising work at the project site) all in one room to “pull” a schedule backwards and identify any constraints (“*The last planner*”, par. 1).

Make Work Ready Planning

This part of LPS is commonly known as “look-ahead planning” and exists to make sure that you can start critical activities on time or “that only tasks with all prerequisites available are actually started” (Koskenvesa and Koskela 104). This look-ahead plan is recommended to be a minimum of six weeks (Barshan 8).

Weekly Work Planning

These meetings are a common feature in any construction company, but in the LPS the weekly work plan meeting serves as a time to create work performance commitments (“*The last planner*”, par. 1). This is the phase where the trades will be held accountable for their shared durations during Pull Planning (Barshan 8).

Learning

Lastly, LPS encourages monitoring and measuring. Percent of Plan Complete (PPC) is used in LPS implementing companies as a simple way to measure what percentage of daily or weekly tasks trades have completed (Barshan 22). The learning phase is the phase where continuous improvements actually contribute to “the reduction of starting problems on longer term” (Koskenvesa and Koskela 104).

3 Methodology

The chapter explains methods and tools that were used in order to build accurate theory based on interviews so that data collected result in tangible solutions in implementing LCM or other CIS.

3.1 Building Theory from Case Study Research

There are several potential methods available to accomplish reliable theories built on case studies, but this paper will use a format promoted by Kathleen Eisenhardt, author of the article, “Building Theories from Case Study Research”. Table 1 shows her recommended steps for a successful study and this method will be explained further in following subchapters.

Table 1 Process of Building Theory from Case Study Research (Eisenhardt 535).

Step	Activity	Reason
Getting Started	Definition of research question Possibly a priori constructs	Focuses efforts Provides better grounding of construct measures
Selecting Cases	Neither theory nor hypotheses Specified population Theoretical, not random, sampling	Retains theoretical flexibility Constrains extraneous variation and sharpens external validity Focuses efforts on theoretically useful cases—i.e., those that replicate or extend theory by filling conceptual categories
Crafting Instruments and Protocols	Multiple data collection methods Qualitative and quantitative data combined Multiple investigators	Strengthens grounding of theory by triangulation of evidence Synergistic view of evidence Fosters divergent perspectives and strengthens grounding
Entering the Field	Overlap data collection and analysis, including field notes Flexible and opportunistic data collection methods	Speeds analyses and reveals helpful adjustments to data collection Allows investigators to take advantage of emergent themes and unique case features
Analyzing Data	Within-case analysis Cross-case pattern search using divergent techniques	Gains familiarity with data and preliminary theory generation Forces investigators to look beyond initial impressions and see evidence thru multiple lenses
Shaping Hypotheses	Iterative tabulation of evidence for each construct Replication, not sampling, logic across cases Search evidence for “why” behind relationships	Sharpens construct definition, validity, and measurability Confirms, extends, and sharpens theory Builds internal validity
Enfolding Literature	Comparison with conflicting literature Comparison with similar literature	Builds internal validity, raises theoretical level, and sharpens construct definitions Sharpens generalizability, improves construct definition, and raises theoretical level
Reaching Closure	Theoretical saturation when possible	Ends process when marginal improvement becomes small

Interviews were the primary focus and according to Eisenhardt and Graebner they are a “highly efficient way to gather rich, empirical data” (28). Furthermore, case studies are appropriate in the early stages of research or to provide new data within an already researched topic (Eisenhardt 548). LCM and the use of LPS has been researched before, but with a fresh perspective brought from current workers and specifically superintendents and foremen, new accurate data has been added to understand what impact a LCM implementation can have and what an implementation should look like.

3.2 Selection of Cases

This research inducts theories based on the experience of workers who were part of an implementation of a new CIS, LCM. Companies were contacted within the Chicago region in order to find superintendents and foremen who initially resisted implementing LCM, but later firmly supported the system. Present author and Dr. Cindy Menches interviewed five construction superintendents and one foreman at four different companies. We reached the sixth interviewee and realized it was enough to begin an analysis knowing that:

“Researchers should stop adding cases when theoretical saturation is reached”
(Eisenhardt 545).

Each interviewee was appointed to assist us with an interview by high-level management at their company and as Eisenhardt explains in her article:

“While the cases may be chosen randomly, random selection is neither necessary, nor even preferable... the goal of theoretical sampling is to choose cases which are likely to replicate or extend the emergent theory” (537).

Our six interviewees were all males from 48 – 63 years of age. All six had some college or technical degree. The four companies that were indirectly part of this research have started implementing LCM. One company has been practicing LCM for just three months, two companies between five and ten years, and lastly one that has been implementing LCM for over ten years.

3.3 Interviews

One and a half to two hours long interviews were conducted and divided into six categories: baseline assessment, past implemented systems, initial reactions, organizational transition, transformation, and impact. Each interviewee answered questions about how a CIS implementation affected workers and thereby their companies. The interviews were typed and are attached and can be read in Appendix B-G.

3.4 Analysis

In Table 1 the analysis is mentioned as "Analysing Data" and includes a within-case analysis and a cross-pattern search. These two steps sharpen the results by using case comparisons in broad terms as well as in detail.

Within-case Analysis

In order to fulfill the recommended step of a within-case analysis Eisenhardt's recommendation was taken into account:

"The goal was to become so familiar with each individual case so that overall patterns would merge into theories" (540).

Visits were made at each interviewees work site and company (all but one). Interview data was collected and analyzed simultaneously in order to get a deeper understanding of each case. Additionally, initial impressions during interviews were typed and recorded as well as each individual's interview, which you will find in Appendix B-G. Eisenhardt recommends this as a first step to become familiar with each case (540).

Cross-pattern Search

The interviews were later compiled into one document, the text separated into select categories to find group similarities and intergroup differences. All to serve the purpose of searching for cross-case patterns. The result was the following categories, which will be found in Chapter 4.1:

- Organizational introduction of LCM
- Subcontractors initial reaction
- The champion's influence
- LPS's effect on collaboration
- Additional advice to implement LCM well

Eisenhardt describes it as:

“One tactic is to select categories or dimensions, and then to look for within-group similarities coupled with intergroup differences...” (540).

The second strategy to improve the likelihood of accurate and reliable theory is to search for cross-case patterns on a more detailed level. In this study, cases were divided into pairs in order to find subtle confirmations of previous assumptions of group similarities and differences. The pair analyses will be described in greater detail in Chapter 4.2 with the following pair descriptions:

- Have implemented LCM the longest and the shortest
- Are the oldest and the youngest
- Once were foremen who implemented LCM
- Are part of the largest and the smallest company (of this research)
- Are part of the same company

Again, Eisenhardt describes it as:

A second tactic is to select pairs of cases and then to list the similarities and differences between each pair. This tactic forces researchers to look for the subtle similarities and differences.... The idea behind these cross-case searching tactics is to force investigators to go beyond initial impressions, especially through the use of structured and diverse lenses on the data. These tactics improve the likelihood of accurate and reliable theory (Eisenhardt 540-541).

The results of the analysis can be read in the following Chapter 4.

4 Result

Analysis involved two steps; the within-case analysis and the cross-pattern search. Since the within-case analysis is difficult to give tangible results on, the cross-pattern search will be discussed in chapter 4.2 and 4.3. However, first out is an informational table of the workers who were interviewed.

4.1 Baseline Assessment

One foreman and five superintendents were interviewed and Table 2 includes information about the persons who were interviewed.

Table 2

Baseline Assessment of Interviewees B-G

	B	C	D	E	F	G
Age	63	48	48	57	49	54
Gender	M	M	M	M	M	M
Education Completed	College: 1-3y	College: 1-3y	College: 1-3y	College: 1-3y	College: 1-3y	College: 1-3y
Current Position	Superint.	Superint.	Superint.	Gen. Forman	Superint.	Superint.
Experience in current position	30y - more	15-20y	20-25y	20-25y	15-20y	10-15y
Experience in construction industry	30y - more	25-30y	25-30y	30y - more	25-30y	25-30y
Lean has been implemented	5-10y	5-10y	0-1y	5-10y	10y - more	10y - more
Position when Lean was introduced	Gen Superint.	Superint.	Superint.	Gen. Forman	Superint.	Foreman

4.2 Major Areas of Emphases

The following five categories were clearly represented in the interviews and each category contains results of the cross-pattern search; similarities as well as differences within the group.

Organizational introduction of LCM

The four companies represented by interview data first introduced LCM as a scheduling tool or system called LPS. An LPS implementation is explained in greater detail in Chapter 2.2.1.

In five of the six interviews, LCM was initially implemented only in select projects to see if it would actually work.

My Vice President... Flynn said: 'Hey, we're gonna try this thing. We think you're gonna be the best shot at it. Help us out here, get these guys involved and see how it goes and report back to us. If it works, it works, if it doesn't it doesn't.' (Appendix D 63)

Subcontractors initial reaction

In all cases but two, interviewees expressed that their subcontractors were initially resistant to LCM. The subcontractor's main complaint was the new scheduling format, specifically the six-week-look-ahead schedule which was briefly explained in Chapter 2.2.1.3. The interviewed superintendents and foreman all remembered their first scheduling meetings similarly:

"The first couple of meetings we were there for four and a half hours long just to get through the damn schedule. The subs are about ready to kill me" (Appendix C 51).

Many subcontractors did not see a need to improve or change their current system:

"...none of the subcontractors had seen it so as we were learning it – we tried to teach them. They had no interest in it at all. That was detrimental starting that. Flat out, them not wanting to come along with you...." (Appendix F 79)

Lastly, subcontractor's initial reactions varied depending on their generation. LCM was seen as a modernization program; a technologically advanced CIS, which according to interviewees would far more likely suite the younger generations than the older.

”Younger people are a lot more likely to change than the old guys that are set in their ways...” (Appendix C 51)

The champion’s influence

The “champion” is someone who masters the implemented CIS, someone who has done LCM before, who is passionate, and eager to push the company forward by implementing it. The champion can include project managers, consultants, or superintendents, and his or her character has the greatest impact and influence on workers’ attitudes, according to the interviewees. One champion’s name was mentioned as much as 29 times during one interview and referred to even more often.

There has to be someone that can be the champion or the king that you can call in every scenario. Like Anthony, you need someone who is passionate about it to make it go forward. If you don’t have someone that is willing to put in the extra effort with it – it’s like anything else, it’s a bunch of policies that are put in place and it doesn’t go anywhere and everybody stops using it after a week or two cause it doesn’t work and they go back to their way of doing things. (Appendix C 48)

Only one interviewee did not mention someone as a champion.

LPS’s effect on collaboration

Five interviewees testified to LPS turning initial skeptics into supportive team members. Additionally, Pull Planning which is the second phase of LPS, explained in Chapter 2.2.1.2, was mentioned to be the initial accountability step to create mutual understanding and collaboration. All six interviewees saw direct correlation between improved collaboration and Pull Planning sessions.

”What’s really nice about this format is: you’re not forcing anything down anybody’s throat anymore. Everybody has input and ownership of that schedule, the last planner and it’s amazing what cooperation you get...” (Appendix B 41).

Additional advice to implement LCM well

An advice given from the majority of the interviewees was to improve LCM implementation by initiating more conceptual LCM training, whether that meant breaking LCM down area-by-area or just explaining how and why the company runs the jobs the way they do according to LCM.

...it's like a job, when you get a job... say this site: 'Wow, look at this job, it's big, it's complicated' and it overwhelms ya. When you stop and when you break it down and you look at it individually in section by section, area-by-area – there's nothing to it, you know. And that is what we did not do the first time. We didn't see the value of it. We didn't stop and break it down and actually go through and get into it. (Appendix B 39)

A piece of supplemental advice was to get “the right people on the bus”, as Jim Collins writes in his book, “Good to Great” (41).

”It's like anything we do here, it comes down to people. With the best systems, with the best tools, but if you don't have people – you will suffer” (Appendix F 83).

Lastly, three interviewees pinpointed the importance of letting the foreman of each trade represent their company in the Pull Planning session and not project managers or others. In order for that meeting to be efficient, reliable and accurate the people who are going to actually do the work need to participate and share their opinions, their durations, and the number of people they need.

“Cause I make them bring the foreman. I don't want the salesman who got them the job or the PM to agree to everything because he thinks he can work it out with my PM... I want the foreman running the job and I want his durations...” (Appendix C 58)

4.3 Pair Analysis

As a second step of the cross-pattern search, pairs were compared and contrasted to identify key points besides the main themes addressed in Chapter 4.1. When pairs are compared more subtle similarities and differences show up. Additionally, the pairs in this study were selected so that initial results by the first cross-pattern search could be confirmed.

Co-workers of the same company #1

Two interviewees, who will be referred to as Appendix F (F) and Appendix G (G), are coworkers in the same company who have both been in the industry for over 25 years and have had 14 years of experience implementing LCM. One contrasting detail that affected the outcome of this pair analysis is that F implemented LCM while he was a superintendent and G implemented LCM while being a foreman.

Clear and direct introduction

LCM was out rightly expressed as the direction that the company was moving in:

“This is what CBA wants to use and you’re going to use it...” (Appendix G 89)

However, although the company stressed LCM as the new ideal, there was no significant LCM introduction for either employee. Regardless, both were expected to be fully committed and use Lean principles without much assistance.

Coworkers’ reaction

Subcontractors initially felt offended thinking that implementation of a new production method meant their current work was not measuring up to standard.

“‘Why [is company x] so much better?’ That’s the push back you get from [the subcontractors].” (Appendix F 80)

Interestingly, neither F nor G experienced major changes when LCM was introduced. F was a superintendent and already highly involved in a 20 weeks look-ahead

schedule (Appendix F 76), while G *“didn’t really think that much about it... It’s like, okay I see the schedule, let’s just go with it.”* (Appendix G 92)

Training

In regards to educating and training individuals in LPS these coworkers had two very different approaches. F, promotes LPS but relies more heavily on individual brain power:

“...a lot of the stuff that some people need to see on paper – you do it in your head... You’d get a feel for how long it’s gonna take for the job” (Appendix F 77) and he goes as far as: *“... You don’t need a lot of training if you got people that understand how it’s getting built...”* (Appendix F 84).

G, on the other hand, also promotes LPS but a fully implemented LPS where teamwork is the goal to help everyone thrive:

“[LCM] is really joining [project managers, engineers, and field leadership] and getting them on each side of each other’s fence” (Appendix G 93) and *“We have to get everybody engaged so that the entire team can be the magic rather than just one person”* (Appendix G 90).

He also promotes the idea of implementing structured learning: *“Absolutely training...”* (Appendix G 91).

Satisfied clients

Furthermore, when asked if the company got more satisfied clients because of their LCM implementation F responded with:

Oh my gosh, that one is just taking off for us. That one is exploding for us. When KLM jumped on with [LCM] four years ago...when they went full boat in, they turned a lot of heads: ‘KLM is doing it, we should be doing it.’ We were already in it and KLM took us, cause we’re so heavy on [LCM]... the opportunities for CM negotiating exploded on calls... it’s all because what we did on KLM. They say ‘take NOP, take NOP’. The game is on. (Appendix F 85).

Similarly, G supported the statement. (Appendix G 93)

Co-workers of the same company #2

The following two interviewees, whom will be Appendix B (B) and Appendix C (C) also worked for the same company. Again, both have been in the industry for over 25 years and have 8 years of experience implementing LCM. The interviews were conducted a month apart and at different locations, since they run different projects. B was a general superintendent at the time LCM was introduced while C was a superintendent. Reading the interviews gives a perspective that B knows more about the company from a management perspective, granted that he was higher up in the hierarchy.

Resistant and afraid

There were plenty of areas where the interviewees from the same company agreed, as seen here with these two having found subcontractors resistant, slow to change, and afraid.

C: “The guys were like ‘that thing’s worthless anyway, in two weeks that’ll be worthless’ ... if nobody been introduced to it at all – it takes them at least two or three weeks minimum to even start to accept it” (Appendix C 58).

B: “There was a lot of resistance not only from myself, but from every superintendent in the field. Every guy said that...: ‘If I’m gonna do this, I’m going somewhere else’ and the reason why, to be honest with you, we were all afraid of it - afraid that we couldn’t learn it and couldn’t manage it. That’s the real reason” (Appendix B 40).

Training

One of the few topics where the subjects’ opinions went different directions was training and how the company could have improved the implementation of LPS. Bear in mind that B was a general superintendent and might have been better educated on LPS during the implementation, because his response was:

“...it was rolled out in and taught in a very good format” (Appendix B 43)

while C would “...pay the extra money for some sort of training that is basically geared for the construction industry... Especially for the field guys, project managers get a lot more scheduled [LCM] classes” (Appendix C 54).

Realistic schedule

Furthermore, the two workers that were interviewed a month apart at different sites emphasized the importance of creating a realistic schedule.

C: “The more reliable that we are with our schedule, with how we do everything, it only makes it better for everyone. You get the buy-in. There is no questions” (Appendix C 57).

B: “Everybody does their thing and there’s nothing better on a project on a schedule than reliability. If it’s reliable, everybody buys into it and everybody keeps moving” (Appendix B 44).

Achieving every goal

Lastly, the Pull Planning session was especially appreciated with its accountability structure as both B and C explained: *“Because... [the subcontractors] hit every goal” (Appendix C 53)* and *“... every milestone that’s on that schedule, you’re hitting it right on the head” (Appendix B 45).*

Foremen during implementation of LCM

Two of the six interviewees were foremen at the time when LCM was introduced. The pair-analysis shows that resistance among foremen is a challenge as both interviewees affirm the theory. In the following pair analysis they are called Appendix E (E) and Appendix G (G).

No training

Training was minimal to none in both cases and neither foreman felt they were given enough LCM or LPS training. E was introduced to the system as a two week look-ahead schedule instead of LCM. This two week look-ahead was “*just briefly explained to him*” (Appendix E 73) by his superintendent. E mentioned that it was more through the culture of the workplace rather than any type of formal introduction or explanation that he came to understand LCM (Appendix E 74) and similarly G explained it as: “*[Foremen] learned on the fly*” (Appendix G 91).

Foremen’s reaction

G felt that LCM was just a more formal way to encourage common sense while E felt that although planning ahead might be nice, it was also impractical and often inaccurate:

It’s a nice thought that you can look ahead two weeks and to be accurate. I hated doing it on one hand ’cause things change daily in a construction site...we have water filling up this hole, and your two-week-look-ahead is out the window (Appendix E 72).

The foremen additionally shared these responses and hesitations that were common on the field:

“We’re gonna make it happen on the field anyway...” (Appendix G 90) and *“the consensus of the two-week-look-ahead – why am I gonna do this darn thing, cause the ink isn’t even drying and [the plan] already changed”* (Appendix E 72).

LPS’s effect

There are of course downsides to every system, no matter how good and E found some of these flaws especially aggravating in the LPS:

“...It seemed like nine out of ten times, [when] I thought I would be using ten guys for a month – I used ten guys for a week... ’cause things change so much.” (Appendix E 71)

G, on the other hand, remained positive on the matter:

“[LPS] drives you towards being more organized. I don’t know whether it made my disposition any sweeter but you would think it would because it made my job easier” (Appendix G 93).

What is LCM?

E explained that despite his approximately five years of officially practicing LCM or LPS, he still did not have a clear and complete understanding of the LCM concept and neither did his coworkers:

“I’m being honest with you, I talked to some of my peers in the trades and ‘What’s [LCM]?’ ... Really, nobody knows... we’re always using it, not knowing what it is” (Appendix E 69).

G felt similarly and could not recall any specific LCM training that he had received in a period of the first four years (Appendix G 91).

Large vs. Small company employees

The comparison between these two interviewees, Appendix C (C) and Appendix F (F), is dependent on how many workers each of their individual company has. The smaller company in this research, at which C works, has close to 100 employees and the larger company, at which F works, has around 2,000 employees.

LCM already practiced

The smaller company seems to have been given a fuller introduction, while the larger had a slight and relatively informal introduction to LCM. However, the two interviewees agreed on the fact that:

“for the most part in construction – you want it to be as Lean as possible anyway... so you’re already kind of thinking in that way.”(Appendix C 53).

So, initially the difference in how they both implemented LCM did not deviate that much from previous practices within the company. (Appendix F 76)

Training

The two superintendents had very different opinions on how important training was and what it should look like where F confidently said that:

“you don’t need a lot of training if you got people that understand how it’s get built and how you’ve essentially built your schedule in your head” (Appendix F 84).

On the other side C shared his opinion that:

“I would pay the extra money for some sort of training that is basically geared for the construction industry... especially for the field guys” (Appendix C 54).

Benefits and downfalls of LPS

Both interviewees agreed on the importance of explaining to subcontractors that they can actually make money, even more money by fully implementing LPS. No matter what size the company is, the key to success is to get the subcontractors onboard, just like F puts it:

“The benefits were when [subcontractors] got all on board and they started to all understand, and we also we learned to differentiate what people we needed in there to be successful when we plan...” (Appendix F 84).

The size of the company seems to be irrelevant in regards to the positive effects of Pull Planning sessions. In both cases communication improved after Pull Planning was implemented. However, for F the session did not always play a significant role. Instead he had more confidence in people; that superintendents in their own power can figure out durations. On the contrary, C mentioned that the session is critical in order for subcontractors to create a more accurate schedule, to feel part of the grander scheme, and to take ownership of their own work. Compare the following comments:

F: *“So, maybe because of where I came from and that little company I worked for was so small and everyone knew what they were doing on the job with*

different durations, you didn't need [a schedule] – you did it all the time...”
(Appendix F 81).

C: *“...it's more about getting people involved and giving people ownership is huge. Most trade guys don't think that anything they say matters, so it's like if they can feel like they had a part or a plan in it – then, they take ownership and make it happen. But if you ram something on them, they're never gonna buy into it.”* (Appendix C 51).

Largest age gap

The eldest and the youngest interviewees (only 15 years apart) were compared to see whether age has an impact on the perspective of a LCM Implementation. The eldest interviewee will be called Appendix B (B) whereas the youngest interviewee will be called Appendix D (D).

LCM as the solution

Both companies looked to LCM hoping it would be the solution to their current company struggles. D concluded that the implementation of LCM was initiated because of its preciseness of scheduling. They were working at a complex renovation project, a 27 stories high building downtown, and needed a new scheduling format (Appendix D 61). It was slightly different from the experience of B who shared that:

“Our jobs were overscheduled, over budget, and we knew we had to turn it around and that's when Andrew stepped up and [implemented LCM]”
(Appendix B 39)

Initial reactions

Both subjects had similar initial impressions of LCM during its introduction to them. Independently of age, both were very impressed by the potential of Pull Planning but the elder felt overwhelmed as how to actually implement it. However, even though LCM was introduced similarly to both companies, the transition into acceptance varied. Younger D accepted LCM as a scheduling tool:

...the scheduling was...one of the hardest things for me, because we have to commit to so much stuff.... So, as soon as they said, 'we're gonna bring in someone and this is gonna help you schedule.' I said, 'Bring him, his brother, his cousin, bring 'em all' (Appendix D 61).

B was terrified of what a new implementation would mean:

"That was the problem, with [LCM]: The way it was presented to us, it terrified us all" (Appendix B 40).

The economy's effect

LPS's success regardless of a healthy economy was a topic not addressed during the interviews. However, somehow LPS's strengths, even in times of recession, were mentioned by both these participants, young as old.

D: *"The whole thing is better for the company, we just went through a hell of a recession, if we had this prior to the recession I think we would be a lot better off" (Appendix D 66).*

B: *"We've grown through this economy. I mean that. We've had a fabulous growth through it all. Most people are either laying off, cutting back, or going out of business. We've been growing.... [LCM] has been the driving force behind it. We have satisfied clients now. We have repeat work...and we finish buildings three months early" (Appendix B 41).*

LPS will prove itself

Our compared superintendents, with an age gap of 15 years, are convinced that LPS will prove itself to be successful if companies are willing to try:

If your audience isn't receptive, then you have to convince them and Pull Planning will convince them – it will just take a couple of weeks. You can't discard the truth, you're gonna see it. It's right in front of you on the [Pull Planning Schedule] (Appendix D 62).

Short vs. long implementation of LCM

Our last pair is Appendix D (D) with the shortest implementation of LCM, being three months in at the time of the interview, and Appendix F (F) with the longest implementation of LCM, now 14 years. The two experiences of implementation will now be compared and contrasted

LCM company wide

Both subjects' companies first implemented LPS in small scale and presently still do not run LCM company-wide. D explained that every week, more of his company's superintendents are getting trained in LCM and Pull Planning (Appendix D 62) while F admitted that there are probably those "*people within the company that have still never done [a LCM job]*" (Appendix F 80). This presents challenges in regards to company inconsistency.

When to use LPS

A distinct difference is visible in collaboration experiences between F who has implemented LPS for a long time, and D, who is new to LPS. Here it is represented in someone who wants to use LPS in all future projects, and the other's opinion that it is not always necessary or even possible.

D: "*I told Conny, and I meant it from the bottom of my heart, that I will never do another job without [LPS]. But, from now on I will do it from day one*" (Appendix D 61)

F: "*Smaller jobs sometimes they will use [LPS] sometimes they won't... a 40,000 dollar job or 25,000 and it's not a lot of money: They won't use it... if they build a little six weeks quick schedule and it's done, they don't do a daily deal cause it's already done in there...*" (Appendix F 82)

LCM flexibility

Lastly, both interviewees emphasize allowing flexibility inside of LCM in acknowledgement that every company, project, and team is different and was well explained by both interviewees:

D: *“When you do Pull Plan there are things you need to be ready to adjust for and that ‘nothing is static’...”* (Appendix D 65).

F: *“If it doesn’t work in [the subcontractors’] heads, [change] it”*(Appendix F 83).

5 Discussion

Though a paper cannot quite do justice to being physically present in a Pull Planning Session, touring dusty work sites, or hearing the actual interviews themselves, the intention is that the information given will empower people who are, will be, or are thinking about implementing a new CIS like LCM. Six construction workers have shared their LCM implementation stories. The words of the interviewees have been typed word-by-word, compiled into documents, analyzed, and in this chapter, I present five challenging topics and thought provoking themes which will be discussed regarding a LCM implementation.

5.1 Champions

Let us return for a moment to the idea of a champion. The term “champion” was mentioned by two different interviewees and five of the interviewees each mentioned someone of similar description. The expressed praise for this person highlighted the importance of someone who truly understands the direction and value of a company practicing a CIS. In one case, this champion was a consultant who was given the task of helping the company on the right track (Appendix D 63). Whether that is a strategy that works in the long run or not has yet to be proven, since the company only had implemented LPS for three months. Similarly, Dr. Michael Pappas, lecturer at the University of Texas, describes a case where they used the same concept of bringing in a consultant to introduce LPS:

A Lean Construction Institute consultant provided one day of introductory theory training for key participants, and another spent one day helping the project team develop the milestone pull schedule. This is considered a key factor for successful implementation of this program. The owner, designer, general contractor, and major subcontractors were all involved in developing the milestone pull schedule (6).

Independent of a consultant initiating an implementation of LCM, a champion within the company seems to give benefits worthy of an investment. The workers need someone to follow, but how is this champion chosen?

Also, in all interviews but one, the “champion” spearheaded the implementation of LCM as a small scale “experiment” starting with LPS, as recommended by Mossman in his article “Last Planner”:

“Stabilising your systems is the first step to making a [LCM] transformation. In project-based productions LPS is a great way to do that.” (4)

A small scale experiment was preferred as long as the direction was clear and according to this research LPS can accommodate that. However, other LCM practices can easily be added and help set the stage for a smooth implementation of LCM. Interviewing these superintendents and foremen, these practices were not mentioned; visual control, standardization, value streaming, leveling the workload, etc. This simply means that the company is at an early stage of implementing LCM, or that the workers do not know or see these principles as they are partly implemented at most work sites, or that the company says it implements LCM but may not fully do so.

5.2 Pull Planning

LPS’s second step is Pull Planning and was one of the most vital concepts of my research. A Pull Planning session gives the opportunity for the team to collaborate and communicate early on to avoid mistakes later. Even more importantly than the champion of a company is the involvement of the whole team, which Pull Planning facilitates by laying a strong foundation of communication. When asked if LCM helped engage the team, one interviewee said: *“Absolutely, gets everybody in the process”* (Appendix G 90) and a similar response was given from each interviewee. So, is it enough to implement LPS and Pull Planning? Is the full concept of LCM needed including eliminating waste, standardization, Kanban systems, etc., or does that automatically fall into place when LPS is fully implemented?

5.3 Resistance

There are plenty of unanswered questions that this research evocated and another one is: How do you get the subcontractors to support a new CIS? All six interviews made

it clear: subcontractors' resistance to LCM is common so it is important to be prepared to help smooth this transition. The one current foreman that was interviewed said firmly that:

"...so many times there were unrealistic schedules the old way... we always sort of said it: that the people in the field – they should be talking to us more."
(Appendix E 71).

Therefore, by getting the subcontractors more involved, giving them ownership and responsibility, one can assume that projects will be successful. Hence, resistance can be overcome in several ways. The initial reaction was commonly resistant and the one negative area that the interviewees kept coming back to was the six weeks look-ahead schedules. It required a lot of work up front, but generated great benefits by the end. There will be resistance. As Koskenvesa and Koskela puts it:

"Even if its benefits are widely observed, it is also a common observation that the introduction of the Last Planner method to a site, into a company or into a country is not an easy and uncomplicated task." (95)

Again, this is why this article was written, in order to give ideas, help, and motivation to overcome resistance in an implementation of a CIS.

5.4 Training

Furthermore, an area of strong disagreement between the parties was surprisingly training. Three interviewees definitely wanted more training, while two were satisfied and the last one opposed to more training saying that:

"that's why I say even with [LCM] people nagging on how much training that we need, you don't need a lot of training if you got people that understand how it's get built and how you've essentially built your schedule in your head"
(Appendix F 84).

It is obviously easy to say that you want more training and not be more specific, so the last comment might include a truth one may need to consider. Is training overemphasized in the academic world? Should the focus shift to getting the right people in the company and learn by doing? Because that was another popular conclusion shared by the workers interviewed: The importance of having people that

want to be a part a new implemented system and take ownership for their own schedule. However, subcontractors were the ones primarily resisting an implementation and the foremen's pair analysis show that training is exactly what these workers would have appreciated at the time of an implementation. That is an indication worthy of notice; conceptual training is needed for specifically field workers.

5.5 Advices from Interviewees

Finally, interviewees took time to think through ideas and advice to pass along. The following three are worth mentioning as practical examples of how an implementation of CIS can take place in order to make the system popular among the different trades and geographic locations:

... [LPS] isn't working..." and he sat me down one day and printed out a schedule that was from three weeks before. He said "Let's go down it"... there was 95% yeps and 5% no's. That was the point where I was "okay, I saw the results... you can see the benefits and you start to believe in it (Appendix C 54).

"...the Lean planner... It's a great system, but it doesn't have to be the same if I go to Denver and other areas" It will look very similar, but it doesn't have to be identical to be effective" (Appendix F 83).

...we kept track of the PPC and everything, and we would give gift cards to whoever had the highest PPC. Let me tell you about motivation within the trades, T-shirts, gift cards, and hats – they are the best motivation... It's amazing what guys will do... (Appendix C 55).

And lastly, the 63 year old interviewee's answer to present author's question: If he was to give advice to workers in a position of implementing LCM, what would it be:

"They've made the best decision in their lives to get into it." (Appendix B 47)

6 Conclusion

Lean, which originates from Japan's "Toyota Group", was first adapted in the construction business in 1993 (Koskela, *Theory-based* 33). Growth is still considered slow even though several companies say that they implement LCM. With the assumption that it had to do with internal resistance, the original objective of this study was to investigate what made initially resistant workers to accept the concept of LCM and what can be learned from an implementation of such CIS. However, the objective was slightly modified since some workers did not mind changing the company's way of running projects. The objective of this study came to be how an implementation of a CIS like LCM can be more effective and smooth in such way that future CIS implementing companies and people can learn from the interviewed workers' experiences.

Five construction superintendents and one foreman were interviewed at four companies. The data collected from the six interviews was categorized into five categories; organizational introduction of LCM, subcontractors initial reaction, the champion's influence, LPS's effect on collaboration, and additional advice to implement LCM well, and later analyzed according to Eisenhardt's model "Building Theories from Case Study Research."

Furthermore, three important factors have to be taken into account when looking at this thesis. For one, the foreman and the superintendents interviewed shared that they implemented the concept of LCM. That might not be the case; they might only implement a small piece of the full system. Through the interviews it became clear that these workers do not necessarily know what decisions are made in upper-management and what the company are implementing in terms of LCM in pre-construction or other stages of a project. However, they know what they practice, which in all cases was LPS at a minimum and thereby the main reason why LPS came to be the system that the study focused on. The second factor that should be taken into account is that Eisenhardt's model of building theories of case studies incorporates time consuming analyses which were done by one person and not multiple sources. Eisenhardt recommends several sets of eyes in order to build greater validity (539),

which was not fulfilled. The third and last factor to take into consideration is that only one foreman was interviewed, and since according to these interviews foremen of different trades are the main reason for resistance – it would have been of great value to interview more of foremen to better understand their experiences and potential resistance to LCM.

So, existing resistance mainly originated from subcontractors and foremen who did the actual field work. Therefore, the greatest challenge to overcome is to understand their needs and wants and perspectives about LCM. Consistent themes to overcome resistance were; having a worker in a leader position that knows the system well and is passionate about the implementation of it, using the LPS as a first gradual step into becoming Lean mostly because of its benefits in improved collaboration, investing in conceptual training for foremen, and hiring people who know and care about what they are doing. The conclusion is that the implementation of LCM will create resistance, but by simply engaging foremen in the field the implementation will assist the success of LCM strategies.

7 References

- “A Brief History of Lean.” *Lean.org*. Lean Enterprise Institute, n.d. Web. 26 March. 2013.
- “Principles of Scientific Management.” *Marxists.org*. Marxists Internet Archive, n.d. Web. 26 March. 2013.
- “The Last Planner.” *leanconstruction.org*. Lean Construction Institute, n.d. Web. 20 October. 2013.
- Ballard, Glenn, and Lauri Koskela. “A Response to Critics of Lean Construction” *Lean Construction Journal*. Special Issue (2011): 13-22. Web. 4 June. 2013
- Barshan, Afshan. “Last Planner in Lean Construction.” *leanconstruction.org*. Lean Construction Institute, November 2011. Web. 19 October. 2013.
- Collins, Jim. “*Good to Great*”. New York: HarperCollins, 2001. Print
- Eisenhardt, Kathleen M, and Melissa Graebner. "Theory Building From Cases: Opportunities And Challenges." *Academy Of Management Journal* 50.1 (2007): 25-32. Business Source Premier. Web. 22 June 2013.
- Eisenhardt, Kathleen M. "Building Theories From Case Study Research." *Academy Of Management Review* 14.4 (1989): 532-550. Business Source Premier. Web. 22 June 2013.
- Ford, Henry. *Today and Tomorrow*. Garden City, NY: Doubleday, Page & Company, 1926. Print
- Howell, Gregory A. “History – A conceptual history of LCP”. *Leanconstruction.org*. Lean Construction Institute, n.d. Web. 9 April. 2013.
- Howell, Gregory A. “What is Lean Construction.” *Leanconstruction.org*. U of California, July 1999. Web. 2 April. 2013.
- Koskela, Lauri, Gregory Howell, Glenn Ballard, and Iris D. Tommelein. "Foundations of Lean Construction" in “*Design and construction: building in value*”. Oxford, UK: Butterworth-Heinemann, 2002. Print
- Koskela, Lauri. “Application of the new production philosophy to construction.” *Ce.berkeley.edu*. CIFE Stanford, September 1992. Web. 28 May. 2013.
- Koskela, Lauri. “Lean Construction as a Movement Towards Theory-based Construction Management.” *Ljk.sdpublishing.org.uk*. U of Salford, 2011. Web. 30 May. 2013
- Koskenvesa, Annsi, and Lauri Koskela. “Introducing Last Planner: Finnish Experiences” *usir.salford.ac.uk* U of Salford, 2005. Web. 18 October. 2013
- Liker, Jeffrey K. *The Toyota Way*. Madison: McGraw-Hill, 2004. Print
- Menches, Cindy. “Lean Construction and Control.” Illinois Institute of Technology, Chicago. 6 February. 2013. Lecture
- Mossman, Alan. ”Last Planner.” *leanconstruction.org*. The change business ltd, 2013. Web. 16 October. 2013

Pappas, Michael. "Evaluating Innovative Construction Management Methods through the Assessment of Intermediate Impacts" *leanconstruction.org*. University of Texas, 2000. Web. 10 September. 2013

Winch, Graham . "*Managing Construction Projects*". Chichester: Blackwell, 2010. Pdf.

Womack, James P, Jones Daniel T; Roos, Daniel, *The Machine That Changed the World*. Cambridge: Rawson Associates, 1990. Print

Appendix A

Interview questions as asked.

PART 2: PAST IMPLEMENTED SYSTEMS

- 1 Has your current company previously tried to implement other continuous improvement systems than Lean?
 Yes No Don't know
- 2 If yes,
 - 2.1 What system was implemented?
 - 2.2 What was successful and what was not?
- 3 Did you hear about Lean before your company mentioned that they would implement it?
 Yes No Don't know
- 4 If yes,
 - 4.1 What was your perception of Lean at the time?

PART 3: INITIAL REACTION

- 5 When you were first introduced to Lean at your company, would you say that you immediately supported Lean efforts or were you somewhat skeptical?
- 6 Who or what influenced your attitude towards Lean?
 - 6.1 In what way did these people or events influence you?
- 7 What arguments were you weighing against and for Lean?
- 8 What reaction would you say was common among your closest coworkers when Lean was implemented?

PART 4: ORGANIZATIONAL TRANSITION

- 9 How did your company announce that they would introduce Lean?
- 10 For how long was the decision to implement Lean discussed, planned and processed before an actual implementation?
- 11 What type of training did you get as the company decided to become Lean?
 - 11.1 How frequently did you receive Lean training or at what interval?
- 12 How would you have handled the transition to become Lean differently?

PART 5: TRANSFORMATION

- 13 Can you describe the turning point when you understood the benefits of implementing Lean?
- 14 How do you think friends, family, and co-workers see differences in your attitude and perspective of work after Lean was implemented? [38:10]

- 15 How did work hours change? [39:00]
- 16 How did Lean change the way you communicate and collaborate at work?
- 17 What professional benefits have you seen within the organization by implementing Lean?

PART 6: IMPACT

- 18 Have you had someone mentoring you through this process of becoming Lean?
 Yes No
- 19 What advice would you give to future Lean implementing workers in the same position that you were in?

19.1 EXTRA QUESTIONS

Appendix B

Interview with interviewee B, a 63 year old Superintendent who implemented Lean about 8 years ago.

PART 2: PAST IMPLEMENTED SYSTEMS

1. Has your current company previously tried to implement other continuous improvement systems than Lean? [4:42]

Yes No Don't know

2. If yes,

- 2.1 What system was implemented? [4:50]

Before Lean? Yeah, we kind of... we used to use what was called a rotation schedule. It is pretty much primarily using residential, apartments and housing, cause at that time we had a lot of residential work and it worked well for that, but the more we got into the commercial end - It didn't work well. So, we tried the conventional two week bar graf, you know, which, you know, at that time was what everybody used and at that time it seemed to work - not knowing anything about Lean at that time, you know. And then we developed, about ten years ago, we developed our own Lean format. We didn't follow Lean perfectly and then we got into the full-blown Lean. So, you know, to be honest with you, when Lean was mentioned guys like myself, who had been doing it a while where panic-stricken, you know. It was like "we will never be able to do this." You know, "it's too much work, too much detail," so it was and so, we said we won't call it Lean. We'll just call it the ABC Schedule because we didn't wanna anyone panicking, you know. So, we kind of, at that time I was a general Superintendent and kind of snuck that in and they didn't panic. It was a form of Lean and it wasn't full blown. So... and it worked for a little bit until the guru of Lean Andrew came along and he's responsible for turning this entire company around. Yes, I'll tell you something, he's, not only the smartest guy I've ever worked with, I've been doing this for 46 years, not only the smartest man I ever worked with, but he's a good mentor and, you know, he's just an excellent person. He has turned this entire company around; I mean we were floundering until he came here. He's an amazing person. I don't know if you've ever met him? He's an amazing person. You'll never tell him I said that.

- 2.2 What was successful and what was not? [7:22]

We did try, we did try the rotation, but we were not successful. That is still what everybody else is using today where a lot of these guys are gone by the wayside because of it. You know, its, you gotta get worth of the times and this is the best scheduling format I've ever seen, you know, and it's amazing. It's an amazing tool. I hate to use the word tool, but it really is. It's just incredible. I don't want to say too much based on your other questions...

PART 3: INITIAL REACTION

3. Did you hear about Lean before your company mentioned that they would implement it? [11:14]

Yes No

4. If yes,

- 4.1 What was your perception of Lean at the time? *Blank*

5. When you were first introduced to Lean at your company, what was your initial reaction? [8:24]

I'm gonna say: about eight years ago we went to a Lean seminar and if I remember right the teacher was Greg Howell. It was in Oakbrook, Illinois, and I had a hard time keeping the guys staying focused. They, you know when somebody goes up and talks about something for hours on Angela Lewis you loose your focus, you know. It was a two-day event and majority of the guys didn't come back the second day.

Andrew is the person responsible for... Bob was into it somewhat. He read the Toyota Way and he was into it. Bob is always on a cutting edge of everything, all right? He really is. He's a sharp man. But Andrew was the guy who made it happen. He was practicing it before. He was working before he came here.

[Really, the first exposure was with Greg Howell going to that session?] Yes

[So about eight years?] Yeah.

[11:21] *The initial reaction was, you know, "we'll never grasp this. This is for..." you know, we weren't that advanced in the IT and we... at that time we didn't have computers in the field for the Superintendents or anything and we thought "come one, just trying to monitor the schedule is gonna take us way too long" and it could not be any further from the truth actually. But, it was a tough sell and like I said that's when we decided we won't call it Lean to freak those guys out, cause everybody would've been out of their mind.*

[Did that help, to not mention Lean?] Yes.

6. What reaction would you say was common among your closest coworkers when Lean was implemented? [12:08]

My reaction was the same as to any of these guys: "We don't wanna touch this. This is way too complicated" and we were all field guys, you know, we didn't have a big educational background where... It's kind of scares... It's like anything; it's like a job, when you get a job... say this site: 'Wow, look at this job, it's big, it's complicated' and it overwhelms ya. When you stop and when you break it down and you look at it individually in section by section, area-by-area – there's nothing to it, you know. And that is what we did not do the first time. We didn't see the value of it. We didn't stop and break it down and actually go through and get into it. We just said, "oh you know, it is way too much maintenance. We need a person just on site to maintain the schedule, you know." We just divorced ourselves from it right there, on the spot, which was, you know in retrospect, a bad decision. We really struggled. We were losing a lot of money every year and we knew we had to get into some type of scheduling format. You know, we had a firm called JKL come in and they were amazing. What a transformation they made with this company and in the short amount of time that they had interviews and evaluations. Their ten biggest points were right on what we needed to improve on and the schedule was one of them.

[43:25] [Did everyone buy into it as much as you did?] *At first, I wouldn't buy into it, "I've been successful for a lot of years" doing what I was doing and I didn't want to change it. "I don't need all this monitoring and don't tell me I'm gonna walk that job everyday with a schedule and I'm gonna go 'yes' and 'no'. It's too much work, I'm not gonna do that." I was probably one of the least receptive guys in the company, just because I had so many years in the business and like I said, "you aren't teaching me anything new. I been there, I've done that, you know and I know how to do that and I know how to do it right." Now you look at what you did and suppose to what you do now. I wonder how I was able to keep a job. It was really incredible.*

PART 4: INFLUENCE

7. Who or what influenced your attitude towards Lean? [15:43]

At that time I knew we were struggling and we all knew, in upper management. We knew we had to do something for lack of... to turn this ship. It was not going very well. Our jobs were overscheduled, over budget, and we knew we had to turn it around and that's when Andrew stepped up and went with it.

[When Andrew first started introducing it, would you say your view was resistant or...?] *Yeah, still resistant you know - resistant and skeptical. "Come on, I've been doing this for..." at that time*

you know say 35-38 years “and I’ve been successful. You’ll not gonna teach me anything.” You can’t teach an old dog new trick, you know, and I’ve always been fairly successful getting the job done on time. “I don’t need this, I don’t need all the extra work it brings”, which it really doesn’t when you break it down. Much easier than working with any other schedule I’ve ever worked with. There was a lot of resistance not only from myself, but from every superintendent in the field. Every guy said that...project managers...: “If I’m gonna do this, I’m going somewhere else” and the reason why, to be honest with you, we were all afraid of it - afraid that we couldn’t learn it and couldn’t manage it. That’s the real reason.

[You had to implement so he, Andrew jumped in several times “so we’re gonna do this and...”]

We had meetings you know, when we sat down and we went through it... In fact I can, give me a second. I can pull out my book real quick. Production management training, you know...

7.1 In what way did these people or events influence you? [22:33]

[How specifically did these people influence you, especially Andrew...? You were resistant, but...?] *Resistant but, you know, open to change - as long as you weren’t terrified of it. That was the problem, with the Lean: The way it was presented to us, it terrified us all. You know, after Andrew and Bob sat down and they broke it down for us and we started studying a little more of it and the light came on like “hey, this is the way, it is gonna help us and you know, we’re not gonna be...” Our problem was our projects always would try to cram the last five months into three months. You know people tripping over each other and, you know, not long and the quality suffers. Besides you’re having an ulcer trying to run a project.*

[13:47] [You went through the training with Greg Howell. Was Andrew with the company then?] *No, I’m trying to remember if he was here. I believe he was here, but he was on a project that day and he couldn’t get away. He was just new to the company. So, he really hadn’t had a chance to implement his views of schedule. He started out kind of bottom row, project engineer and it’s one of those... It’s never been that way at ABC, but people feel that if they’re not in upper management then, you know, it’s better if they keep their mouth closed and just work hard and that’s not the case here. Eric and Bob have always been the type of people that encourage your input and your ideas and no matter where... you could be, you could be the newest laborer around the job and you got an idea – they’ll listen to it, you know. They’ve always been that way, but I don’t think Andrew is one of the rough feathers right away... until he got his feet set, so. [Was he the one that helped get it going?] He was instrumental, without him, I... you know, Bob was trying to get it going but I don’t think Bob understood it as well as, I know he doesn’t understand it as well as Andrew... even today. You know, back then he was... We tried to put it together with our own ideas and it just didn’t work well. When Andrew finally stepped in, they said, “you take charge of this and this”. [So he stepped in a little bit after you got the training?] Yep.*

PART 5: ORGANIZATIONAL TRANSITION

8. How did your company announce that they would introduce Lean? [25:41]

It was in a company meeting and they rolled it out and, you know, we had handouts and everything prepared about Lean.

[If you had to estimate how many people were there that meeting... these were all the superintendents and other people responsible...] *Yeah - superintendents, PMs. I would say, at that time, there was probably 20 of us.*

[I am envisioning the environment trying to roll this out to these people, so go ahead and...] *It was, there was still a lot of nervous signs and a lot of apprehension, but once we started getting into it and breaking it down area by area, rather than trying to swallow this whole Lean concept at one time, was very critical to us... Then everybody, you know, wasn’t so afraid of it anymore. It was a lot easier to work with the handouts and listening to Andrew, Charlie and David who had, David, who had worked with Andrew and studied some of his ideas... initiatives was rolled out very nicely and we adapted it little by little, not over night.*

[It wasn't unexpected that you wanted to do a change within the company...] *No, like I said: we had, we were just going in the wrong direction and it's too good of a company for that to happen, to put excellent people in that position...*

9. For how long was the decision to implement Lean discussed, planned and processed before an actual implementation? [27:52]

[so you expected a change around that time anyway?] *Yeah, we had to. If you looked at Eric the meeting last week, he doesn't tell people how much we've grown through this economy. I mean that, we've had a fabulous growth through it all. Most people are either laying off, cutting back, or going out of business. We've been growing and he... I say that I don't wanna say it, people would lock me up in a room and throw the key away, you know. But, this is... I mean Lean has been the driving force behind it, you know. We have satisfied clients now. We have repeat work, because... and we finish buildings three months early and you look at all the money that they've saved in construction... and now they open earlier and generating money. You got a very satisfied client who wants to do repeat work and, you know, they're up there on the wall. ABC was within the top companies in Chicago to work for. The word is out. We're an awesome company. What's really nice about this format is: you're not forcing anything down anybody's throat anymore. Everybody has input and ownership of that schedule, the last planner and it's amazing what cooperation you get and... here, we've had 26 delay days since I started on February 8th and we're still ahead of schedule.*

[30:05] *Probably at least 18 months, that's my best guess. I mean, Andrew and Bob would probably be better to ask that about that, but I remember, you know, we talked about it we did, I mean, you gonna ask Andrew... We met in the mornings, we had a committee, our scheduling committee and we worked on this, the ABC Schedule – not full blown Lean. Bob said, "so what time do you want to meet?" Andrew goes, "let's do it at three o'clock in the afternoon." I said, "no, it is too late in the day and everybody's burned out. Let's meet at five o'clock in the morning in the office..." So we met for many, many, many months. Twice... Once a week at five o'clock in the morning.*

10. What were your company's expectations of you? [32:41]

At that time I didn't wanna work downtown, so I said "no" and gave up the management job to come back to the field and actually, it worked out well cause we had a big huge job in Aldine and we're... I'm sitting there trying to interview superintendants and I'm thinking "I'm just gonna do that job myself". At first Eric said "No". He wanted me to stay in my position, but I said "It's either that or I'm gonna go". I wouldn't go, but he didn't know that. Eric has always been, both Bob and Eric are the type of guys I would do anything for. They're the best owners in the business. I couldn't even imagine working for anybody better than them. I'm so happy doing it. You know, over 46 years now... I worked for one company 28.5 years. I've been here 18 years. Well, I worked around a lot of other owners, but I can't imagine anyone being better than Bob and Eric. There has not been one anniversary that I didn't get a call from Eric If it's a Sunday, Saturday... it could be a holiday: he calls and that's the type of person that they both are.

[So you went back to the field and were they pretty clear what they expected the field people to do? Like how you were suppose to implement Lean techniques?] *Yeah, I mean, like I said: with the training and stuff we had, you know, we're monitoring and they're monitoring to make sure that it would be implemented and if certain people were struggling with it, then they got more help and you know.*

[When they started to implement Lean you wanted to be more at the field and do field work. Was that thanks to Lean?] *No, no, I just didn't want to do the other job anymore. But now, to be honest with you: If I would have been stuck with it... one reason I got out of it was we were struggling so bad and it was just... all I did was put out fires, okay? I didn't have time to sit down and go over schedules and sit with the guys and talk like a general superintendant should. It was from one fire to the next, you know. I got to the point where I even hated to pull up on a job because I knew it's gonna be a crises and they were looking to me to put it out. It got overwhelming. Now, it would be a piece of cake. We're still learning the Lean, you know. We're not masters of it by any stretch of imagination, but we're a lot better at it than we were when we started and we continue to learn and get better everyday.*

11. What type of training did you get as the company decided to become Lean? [35:57]

[Let's ask him about the training. I imagine it has changed over time. Do you remember when you had your first training with ABC?] *Greg's training was a mass... almost convention, you know. It was huge and it didn't help the fact that they were talking way over our heads, okay? You know, they were using all the Lean terminology and then it's like we're sitting there "what are they talking about?" We didn't even know and had we known what a great system it was, I think everybody would have wanted to come back and hear a second day, but it was just, it was for more advanced people than newcomers. That didn't help sell it.*

[What was then your very first training session? Useful training session] *Jeez, yeah, it's all ABC. We never... that was the last outside training that we seeked out, if that's a word. It has all been in-house training, like I said, from Andrew, from Charlie, from David and Bob. We're always looking for ways to do everything better, you know. We never settle, "that's it, we're good for now", "there's always something better out there". That's the attitude we have. I don't want to keep being repetitive, but the change that's made...*

[31:01] [So from that day, when they had the sit-down meeting – it took 18months and you got training through this time?] *And then we got to the point where we're doing some form of Lean and that's when Andrew pretty much took over and said "okay, now we're gonna take the next step. We gonna do it..." you know. Implementing piece by piece and still had training, you know every month we had a training class and if you ever had problems – you'd either call Bob or Andrew. They were always there to answer your questions.*

[So, going back to this implementation. Was it mostly the focus on the last planner for starters or was there other aspects to it...] *No, it was pretty much... when we talked about... we touched on waste, not as much as we do now, you know, now that we're in to it - for a couple of years now big time, but then we talked about waste and some other issues, you know. The focus was the last planner, trying to get everything scheduled. Not working - to use pull schedule, which is incredible the way that works... I'm 64 years old and if it wasn't fun for me, I wouldn't be doing it. With this new format, I enjoy coming to work every day.*

[18:15] [You've been through this a couple of times? So, they do this pretty regularly?] *Yep, and you know... It made everybody a lot more at ease because we had something to go back and look at and you're out there on an island all by yourself. You had, you know, besides using Andrew, you know, you had this to go back to and it really helped. You got reference to something you can depend on. You can go look at it, so, a lot easier...*

[So that book, that training session I imagine has evolved over the years but they started it way back then?] *Yeah.*

[And the whole point is to teach the last planner to you?] *Right, right. No, Bob has believed in this for a long time, you know, and nothing against Bob, I can say Bob is a brilliant guy, but I don't think he knew how to institute it and get it going as well as Andrew did. Andrew was the driver, you know - he still is, to this day. He hates it when I call him Google, but he really is. He's an amazing guy. Between him and Bob, you know, and Charlie and David and... Between our upper management they've really put together a heck of a plan, you know. It's amazing. I think it's the best in the business. You know, I don't... I talk to my friends who work for other people and everybody's struggling and I know a couple of companies that have taken our schedule. They've got it of some owner's rep's stuff and tried to adopt it and you know, without knowing what goes into it and how to do it –they can't do it as well as we can. You know, up front it's a lot of work. It really was, you know, but now – jeez, it made everything so easy, it is incredible. It's almost a joke...*

[9:10] *And we've sent four of our people out to Denver for training Lean.*

11.1 How frequently did you receive Lean training or at what interval? [39:16]

[Did they require you to go through training every month?] *No, it was... they would set up the dates. It would be like every three months we'd have a meeting and sit down.*

[Even now?] *Yeah, we have, still have training on it, you know. Charlie's rolling out a new one here. He's working on that... We're always trying to improve and make things better. Never settle.*

12. What other resources did the company give in order to help you transition to Lean? [24:16]

ABC is very good about training. They do not mind spending the money, all right, and the time it takes to train people. This has turned our whole company around: Our profit margin has gone way up. I know that because my year-end bonus had gone up by 500%-600% since we started this. So, we're making money somewhere - they're not just giving it away if we weren't making money, you know. They're very good people, very generous people, but to give bonuses like that, those increases - you gotta be making some money. All of our departments... the gentleman in there, Frank, he was... he did a... we did a job in Belden - we finished it two months early. I went from Cornelia and finished that job three months early. It's only because of the Lean initiative and the buy-in you get from the subcontractor. They go from job to job and see how well it works and you know at the end of the job they got folding money in their pocket - not change, you know. It has been incredible.

[40:54] *Everybody got the book "The Toyota way" and if you wanted to read it, you could, if you didn't, you didn't have to, but everybody pretty much read it. I mean, if they are gonna go up to the expense of giving you a book, you should read it and everybody read it... and you know, there was a lot in there that people did not understand, myself included, but it was very informative and helped you understand the Lean initiative/the Lean ideas better than somebody telling you in a class room... Anything, any idea you have or any class you could see that you'd like to take - they'd help you and go head and talk any class you want... Training benefits us all.*

[50:25] [This is a more practical question, when do you do your daily walk?] *I normally do it after lunch everyday. You know, I go out in the morning to see what's going on, but I go out in the afternoon again and that's when I do my walk with the... we don't use the hand schedule anymore, we all have I pads and we update our schedule right on the Ipad.*

[Is that helpful?] *Oh yeah, I mean doing it by hand is nice but with the Ipad it's really nice. If you run it, you see a trade didn't make their commitment that day it might be because of somebody else. You can take a picture right away and "here, you did this, but he didn't do that". It's nice. That's a lot of money and that's how committed ABC is to this format. The main reason why Superintendents got I pads was to help and make it easier to monitor the schedule. It sure does, you know. They'll give you any tool you want to work with to make your life easier and make the job run smoother.*

[and the Schedule is in Excel] *Yes.*

[1:08:20] *Andrew, Bob, and we went to a few of the Lean... like in November we gone there, that was nice. It was all on waste and I still have... You always learn, if you go back and look at my cabinet. I keep it there as an office spot, but it is all labeled "pen", "pencils", "clip"...It's about waste, okay? Before that, it was like "where did I put my pen? It's somewhere here" and now I know exactly where it is. My whole cabinet is labeled.*

13. How would you have handled the transition to become Lean differently? [42:24]

No, I think it has been rolled out and instituted here, almost to the letter. I couldn't think of anything else that we should have done differently or like to see done differently. It wasn't a format that was jammed, felt like it was jammed. I mean, they told you to do this or leave the company - it was rolled out in and taught in a very good format. We knew we had to do something and everybody was buying into it, you know.

PART 6: SUDDEN vs. PROGRESSIVE

14. Would you say that you immediately supported Lean efforts or were you somewhat skeptical? [44:25]

No, and I wasn't the only one. There was a lot of guys that were very skeptical and didn't jump on the bandwagon right away. When you've seen what an amazing tool it was, it didn't take long before everybody took a drink of the cool aid.

15. What arguments were you weighing against and for Lean? [47:00]

Basically, all the main principles... the monitoring and establishing etc. "You gonna tell me I can forecast six weeks out? I don't believe it. There's no way you can forecast accurately six weeks out and maintain that". I used to tell them that my battery in my crystal ball only last that long. But now, when identifying any constraints and everything, six weeks out ahead of time is very... it's manageable. It really is. It's easy to do it. The daily monitoring, I was against that. There's no way I can walk the site everyday and monitor 50 tasks and still do monitoring stuff well. Not only, as it turn out, is it very easy to do, but it also while your doing it: it's a quality mark at the same time. You know, you're monitoring the quality and you're looking at things and you're more into the project than ever before with this schedule because, you know, it makes you do the daily things and everyday you know exactly where you're at on that schedule... everyday. It's not a surprise, but with the old format, "oh, this three weeks, we're at the end of the month, we lost three weeks in a month? What happened?" With this schedule you know precisely every single day where you're at: If you're behind, there's a reason for it. You go back and you check the PPC and you see the guys that didn't make their commitments and then they, you have a talk with them, why they made that commitment and what they'll gonna do to catch up. The schedule doesn't give a chance to fall behind anymore. To be brutally honest with you, there was times when we all thought there would be a lot more work and none of us were looking to bring anymore work into our lives, okay? It couldn't be anything further from the truth because, it's just mean running a project much more easy and enjoyable. That's the key word in it all: it's enjoyable again, it's not a job anymore - it's that fun. Now, it's just fun everyday to come to work. You know where you're at everyday. There are no surprises and I'd say forecasting out the six weeks and staying up on constraints... it's very easy to run a project with this system.

16. Can you describe the turning point when you understood the benefits of implementing Lean? [52:01]

The light went on like that. Once we got into it and we started training and you started listening to guys like Andrew, Charlie, and David who had put a lot into it and had really understood it and thought through it. "Wow, look at the benefits here, this is gonna work." We started rolling out our job little by little and you could see the difference that it made "Why didn't I have this 20 years ago? I can do another 20 years in this business if I had it" It really has made that much of a difference. There's nothing worse than going back to the old format where, I'm not kidding ya, you'd go home and you couldn't sleep because, number one: you didn't really know where you were at on the schedule, all you knew is that you were behind because you didn't monitor it that closely. You know, you did it by the week, not by everyday. "Oh yeah, this week I lost a day". All of a sudden, by the end of the month you're two, three weeks behind and now you're panicking, you got ulcers. I'm not kidding ya, I had bleeding ulcers. I was in the hospital for two weeks... because you can't focus on anything, you can't concentrate cause, you know, you're behind and, how you gonna do it? You can't put 50 people in one area and work efficiently and get good quality, it just doesn't happen. You can't work people over the top of one another. It was a nightmare and I can tell ya. Anyway, I did this for a very long time. I was successful, I didn't know a lot of success until we started this format, believe me.

[53:54] [so you could see results and benefits right away?] *Immediately. Especially in the subs that was there buy in, when they've seen it worked and everybody was held accountable – not just a certain trade, everybody on that schedule was held accountable to meet their commitments. What's nice about it is, it's their input – it's not our, it's not us saying "well, you know what this situation will take you three days". You know, if they come to our phase meeting and they tell us they want ten days on a task that we know will only take three we'll say "no, you know, let's talk about that. We don't think you need that much, let's meet middle road – we'll give you five, alright?" So, it's their input, so it's up to them... as long as you know, we can give them the space that they are suppose to be working in on that day – it's up to them to meet it. So far with this schedule, you just keep rolling along. Everybody does their thing and there's nothing better on a project on a schedule than reliability. If it's reliable, everybody buys into it and everybody keeps moving. If you turn out something that's not reliable than you got a mess on your hands. That's what we used to have, that we do not have anymore.*

16.1 What was the final push that turned you into a firm supporter of Lean? [2nd 1:08]

[How long would you say it took to notice the change? Was it like immediate or just a year to really...] *No, I would say it wasn't overnight but... I would say over the first three months you could see things were changing and then the biggest thing was people's attitude were changing, which you know, you could be the best scheduler in the world but if you don't have people that a: buy into it and their attitude is correct – you're not gonna be successful. Everybody has to look and see, like I said: it has to be reliable. If it's reliable, people can bandwagon and join in. Nobody wants to sit in our weekly meeting and when we go to the PPC and say "hey, you know, you guys finished your mark last week. You didn't get this roof in ad now you're holding the plumber and the electrician back." Nobody wants to sit there and be embarrassed so everybody does everything they possibly can to make sure that they don't miss their commitment and their dates. It's not a jumbled up rat race, it's organized and laid-out, and it's incredible how well it works. I mean you don't get a job like this, when you got 26 delay days and you're still ahead of schedule. You know, it doesn't happen by luck. It's a lot of work and it's people believing in what you're doing and they see how well it works.*

PART 7: IMPACT

17. How do you think friends, family, and co-workers see differences in your attitude and perspective of work after Lean was implemented? [55:20]

My kids and my wife noticed it, I'll tell you that. Oh yeah, you go home irritated everyday and you can't believe it. You're trying to leave your work behind you when you go home, you know, especially with the family. You just couldn't do it, cause you knew you were in a mess. There was no way to figure it out, it's just "oh well, I've gotta do something, I'll think of something". Well, there is nothing you know. It's just you're turning out projects that were inferior and the budgets were long gone. You were losing money. You did not have a happy client and an unhappy owner in ABC. I can say, I was a little... in a different area because I had enough experience where I could sometimes turn a bad experience into an at least a break-even job, you know. A lot of guys, I don't knock on anybody, but most of them didn't have a lot of experience at a job that suffers, but even though I was fortune to do that, if you look at the way we do it now, it's a joke compare to the way we used to work. It's incredible.

[You said it before, but your attitude now is that... do you enjoy going to work?] *Oh yeah, I love... I have a home in Florida, I could be down there if I wanted to, but I choose to keep working because it's a challenge and it's fun. There's nothing... I like nothing better than sitting there and meeting with these owners to say "you know what? The 20-week schedule we thought was gonna be building up, we gonna do it in 18" And they go "huh?" Without fail! Whether depending on concrete, okay? You're always depending o weather. You know, that makes you feel good. You sit there and feel 10 foot tall and you know you can do it cause all the controls are there at your fingertips and you're hitting every milestone that's on that schedule, you're hitting it right on the head, you know, if not above.*

17.1 How did work hours change? [57:48]

[Did it change your work hours too, in a way?] *Ohoho, yeah. I go... everyday at 3:30pm I lock the door and I kind of go home. To be honest with you, I don't have to think about the job anymore when I go home, okay? Because it's there right in front of you, on black and white, you know where you're at and you know what's coming down the road for the next six weeks. Then you realize six weeks out "I'm gonna start my mason, what do I need in six weeks? I need lintels, galvanizer..." and it's all on a schedule, all checked of, so you don't have to worry in six weeks. Everything is there and you go to work. You can turn your mind off. When I leave that gate... I can be honest with ya, and I tell Bob and Eric, I don't think about this project at all until I pull out the gate the next morning.*

18. What professional benefits do you see in implementing Lean for a person in your position? [59:14]

You got totally satisfied clients now, which is probably the biggest key to it all because satisfied clients give repeat work. Repeat work keep paying your bills... In this economy, to have people come back and give you jobs “here’s your project, give me your budget” – not going of to bid anywhere else, we’ll work with your budget...

18.1 What professional benefits do you see in implementing Lean for your organization? [1:01:44]

[So, Safety wise – Has there been a good improvement thanks to Lean?] *Oh yeah, from a safety standpoint, you know, they talk about it weekly and the guys, when they’re done with their activity, they leave that area as they found it, all right? Which is, if a carpenter goes in there and the area is all clean, by the time he’s done with the sawing and cutting: that area is to be put back exactly the way he found it. For safety, that’s a big issue.*

[Environmentally, have there been more initiatives alongside Lean?] *If I was a LEED guy I’d probably be able to answer that for you... I’ll know when I see it, but I don’t think it’s gonna be around much. It was a big thing at first to see a lot of owners and developers that were jumping on it, but this building here is not LEED. You don’t have a Daley pushing either, which is a big thing in the city. He was very much a green guy.*

19. How did Lean change the way you communicate and collaborate at work? [1:05:26]

[You’ve must have talked to the subs etc. in you meetings in a certain way and then you adopted Lean and last planner.] *Well, with them having input in the schedule and ownership it’s a lot easier to communicate with them than it is if it was all our idea, which really doesn’t work when your... you know, the old days of pounding something down somebody’s throat are over with, you know. It just doesn’t happen anymore. Guys lose interest when you try to force things on them... they lose interest. When they have ownership in it, they buy into it: the liability of the schedule. It’s easier to communicate and get your point across... It took a lot of learning. We used to run the job on the fist you know, it was “our way or go somewhere else and work. We don’t need you and we’re gonna tell you how long it’s gonna take ya” and that’s why we were always behind schedule.*

[So it’s more teamwork oriented now? Did it take a while to get to that?] *Oh yeah, because the subs were just as skeptical if not more than we were when we started it...*

[... so aggravating being on a job site] *You’re not building on any relations; you’re just tearing em down. The end of the job “we don’t ever wanna work with you guys again” and feelings are mutual from the sub. You know, the company I worked for before I came to ABC, the owner’s philosophy was “you see that blue book there, with contractors in Chicago... they don’t want to work for us again? I don’t care, I got plenty of em’ that I can call”. So we’re trying to build relationships.*

[So you would say that the main reason why collaboration and teamwork is better now is that you have that meeting in the beginning of the projects?] *Yeah.*

20. Have you had someone mentoring you through this process of becoming Lean? [1:08:20]

Yes No

21. If yes,

21.1 Why was mentoring necessary or why not? [1:08:20]

Andrew, Bob, and we went to a few of the Lean... like in November we gone there, that was nice...

[So, did you actually have mentoring one on one too?] *Well, you know, we did it in group sessions when Andrew would come out to a project, if we had problems – he’d sit down or Charlie or David. Charlie and David are pretty darn good at this scheduling too, you*

know, they've taught quite a few classes. Nobody is as good as Andrew, the guy is just amazing.

22. How are you helping others to implement Lean? [1:10:31]

I don't, because I'm not in that position anymore. You know, the guys would call me and they'll ask certain questions. I try to answer them as best I can, but I always refer to Charlie, David, and Andrew. I don't want to... they are the experts at it. I'm still learning, everyday.

23. What advice would you give to future Lean implementing workers in the same position that you were in? [1:11:12]

[So when you went to the event last November, did you stick around and talked to people?] For a little bit we did, but we always want to beat the traffic... Didn't do a lot of talking... a couple of guys from DEF and GHI... that was about it.

[If they were like getting ready to implement Lean but they hadn't done it and they seemed skeptical, what would you tell em'? What would you say that are words of encouragement or what to expect?] They've made the best decision in their lives to get into it. That's really all I can tell em'. What it's done for us, for ABC and the mindset of the people that work here in the healthcare division. It's just 360° from what it used to be.

Appendix C

Interview with interviewee C, a 48 year old Superintendent who implemented Lean about 8 years ago.

PART 2: PAST IMPLEMENTED SYSTEMS

- 1 Has your current company previously tried to implement other continuous improvement systems than Lean? [9:20]

Yes No Don't know

- 2 If yes,

- 2.1 What system was implemented?

Yeah, at the very beginning there were some basic rudimentary type procedures to follow as far as startup things and job stuff and scheduling... stuff like that. But it was pretty basic at the time, because most of the projects they were doing at that time were in the five million dollar range – where most of our projects now are, anything that I'm involved in, I anywhere from 12 and up. It's a lot different as far as the size of them. So, they had to change. That's probably one of the good things; they are not another guy that wants to... "we've done it this way for 40 years". They are willing to change, that is a good thing.

- 2.2 What was successful and what was not? [10:36]

No, cause there was really no good follow through or... you know.. someone champion it. You kind of need to have, in my opinion, when you gonna do change or something like this. There has to be someone that can be the champion or the king that you can call in every scenario. Like Anthony, you need someone who is passionate about it to make it go forward. If you don't have someone that is willing to put in the extra effort with it – it's like anything else, it's a bunch of policies that are put in place and it doesn't go anywhere and everybody stops using it after a week or two cause it doesn't work and they go back to their way of doing things.

- 3 Did you hear about Lean before your company mentioned that they would implement it? [11:40]

Yes No

- 4 If yes,

- 4.1 What was your perception of Lean at the time?

Not so much Lean, but when I was at BCD and CDE... the famous words "fast-track" came out. [That's definitely not Lean...] yeah, that's not Lean – that was just "cram as many in there as you can and get the job done as fast as you can". So, that's pretty much most of the policies I've had... CDE was the same was as BCD, we got a lot of different stuff with that, because it was like "we'll just get a different sub". Where the mentality here is "we have a core group of guys that give us good prices and do good work for us and have good input, and we spread that wealth" But we know by giving it to those guys, that when the crazy superintendent like me and Tom at the field are yelling and screaming about something that need to get done 90% of the time – they will do it because of our relationship with them... Because of successful projects and everything else.

[So you didn't here about Lean specifically?] No, Lean was pretty much when Anthony introduced it. Nothing as far as detailed program on regiment your job and make it productive.

PART 3: INITIAL REACTION

- 5 When you were first introduced to Lean at your company, would you say that you immediately supported Lean efforts or were you somewhat skeptical? [13:20]

[So, when were you first introduced to Lean?] *That has been almost seven-eight years ago when I first started. I think it was, Anthony started about a year after I started... So, it was right after he started that we got put on a project together and I was doing the typical two-week schedule or whatever else. He brings out this six-weeks schedule thing and I thought he was crazy.*

[So, did you immediately support Lean or were you somewhat skeptical?] *No, no – I was definitely skeptical. [Was that mostly because of the six-weeks look ahead schedule?] At first I didn't think of the thought of making everybody have a commitment. My thought has always been, you will never get the attention span of the guys at the field for more than a couple of weeks. They don't wanna give you commitments more than that long... My past experience was if they gave you commitments it was like shooting in the wind anyways, so whatever they were giving you for information was worthless. So, that's why we always stayed with that two-three weeks window – cause nobody ever seemed comfortable of committing to anything past that point.*

- 6 Who or what influenced your attitude towards Lean? [21:50]

Anthony, he's like "this is what we're doing, I don't care if you believe in it or not. I believe in it" I remember him saying "In a couple of months from now, you're gonna thank me Greg" and I did. But, at that time I would have liked to beat him with a two-by-four. I remember we were arguing about something on the phone and he goes "when you want to talk nicer to me, call me back" and he hangs up on me.

[Did anyone influence you the other way around? That Lean is not good for you, with negative consequences?] *Other than most of the trades and whatever else, when we started introducing it "this is never gonna work, you can wipe your ass with that thing" That's their motive on 90% of schedules, they think they're worthless. And most of them are, right? Mhm.*

[23:15] *When we went from phase one to phase two, we had all the same subs except the plumber and one other trade. I remember going to the first phase meeting and we're talking about things and we're talking about the schedule. The plumber comes in "I want seven days for rough". I didn't even have to say a word, every other trade jumped all over his ass "bullshit, you don't need many days. You did it in this many days over here..." The guys were like "that thing's worthless anyway, in two weeks that'll be worthless". Every one of them said "Okay, but I know who's not getting a Home Depot card". [Did they jump on board later?] Oh, he got it probably after... same thing, to me it's always if nobody been introduced to it at all – it takes them at least two or three weeks minimum to even start to accept it. It's probably about a month or a month and a half when you start to see, or I go back and I can show it to them "hey, we said we would gonna do this on this date and we did it on that date" or "we did this on these dates". As everybody else, if they need three days they'll gonna tell you four. Until they get to the point when "Okay, I'll take the fourth day, but I clog it all in on my schedule and "so and so is not ready for me!" "It's because you were done in three days, three days, three days... you'll wait for one day, cause you told me four". So, if you can show them that by pan the schedule or whatever else – it will end up screwing him later, that's the best. Because, he's like "oh, that's why he wanted real dates". That are gonna be things that aren't gonna change. We can't do something cause it was raining or we didn't get a delivery. There are going to be things that change, but I said "the milestones will never gonna change". So, if something happens during the week... Whatever the scenario is, we're either gonna work some extra hours or we gonna have to work Saturday or we're gonna have to do whatever... to catch back up.*

- 6.1 In what way did these people or events influence you? [27:25]

[How did Anthony motivate you?] *At first it was basically, he was trying to be the nice guy and of course, I was the guy going "no, I'm not doing this no matter what you say". Because at that point, I worked at a lot of places – I've worked with a lot of great people with great intentions like Anthony or whatever else. But, usually it lasts two weeks and then it's done. So, I'm like "I'm not putting all this effort into this for it to go by the wayside for freaking weeks". He basically assured me "no matter what you say, this will*

never go away". He goes "this will be moving forward, embrace it or you're gonna be catching up to it later". We have a few guys, you know we have a lot of guys in our company – if they did multiple jobs, they don't wanna do a schedule like this, cause everything changes so fast and they're updating their schedule and part of that I can agree with. But if you got any type of project with any type of subs – I don't see how this is not efficient. The best part about Anthony is that unfortunately he had to go through Chuck and Dan right away, because of his passion and because of him going to them saying "this is what we should be doing and this is how we should gear our businesses. This is how we need to make more money, be more productive, and I mean the whole thing that I didn't realize at first I guess was... I want my subs to do good and I don't want them to lose money or anything like that... but I guess I didn't really realize the benefit to my subs by doing this. Because, it's like I had a lot of guys tell me "God, you guys must be assholes with that schedule. Delivery only this time and only delivery that..." But, a good example is, I was just talking to a superintendent at the hospital – one of the PMs and he goes "hey, you have that six weeks schedule? And all that stuff over here?" I go "Oh yeah, It's part of our company. It's mandatory, it's what we do... why?" and he goes "well, they put on a schedule... delivery of this area only and delivery of this area only... as they needed it". I said "why?" He goes "I lost my ass at that job, because we lost 140h because of moving material". He didn't listen and delivered it all and FGH is like "move it, move it". He lost his ass because he just spent 140 hours moving material. He goes "I will listen next time and I will look at the schedule when it says deliver this only. I'm gonna plan on six deliveries... It costs me an extra 1000 dollars and an extra 200 dollars to deliver it, but it just costed me 14 grand of labor. By showing people that the planning and stuff works and that they save money and they make money – it's getting people out of that old mentality of... I mean the younger kids that went out there are much more adapted to it than the other stuff. The younger PMs, cause they're getting taught... the project, the scheduling in a much more intense way than the guys from the old days who "just wing it" you know. My first few jobs, we never did schedules or whatever. "How many days will it take you to do this and this and this?" and you'd figure it out. There was never any way of proving anything, where the six weeks schedule – if they don't do it, I can look at my Xs at the end of the week and say "well, you didn't start until Thursday... that's why you're not done on Tuesday..." or if they are suppose to start on Tuesday and it's Thursday and they haven't started – I'm gonna be on the phone "where are ya? You're working this weekend? Or extra hours? Are you bringing more guys?" So, it's a ticker for me too because instead of it being too late to do something about it – you can see the progress and go "oh shit, I gotta get on somebody's butt". Before, you'd forget about it and it wouldn't be done and "I can't do it because the plumber hasn't done this yet!" Well, you just wasted four days or five days or whatever else cause nobody thought about it or it wasn't out there. It makes my job a lot easier now that you put it in there. [But you didn't see that at first?] Nooo, because you're so used to doing it the old way and it's just blood and guts and dirty. You just get in there and get the... we always got the jobs done. But you are yelling and screaming and you're fighting. The re-work... cause if something wasn't coordinated right... Just the pre-planning alone probably saves your stress levels...

7 What arguments were you weighing against and for Lean? [33:22]

[Did you have any pros?] At the very beginning, when they first ran it – I couldn't see any pro getting this six weeks monstrous schedule out there. But then as we started doing it... one of the things, typical lead time on most stuff is four to six weeks - so, if you got a six weeks schedule it's right on that schedule way out here, but when it gets to this date "well, I didn't know you wanted it on sight" "You've had the schedule for six weeks..." You know what I mean? It's good for the subs too, it's like a trigger for them as they're looking at the schedule and going "aw, I gotta install a trip... shit, it's three weeks to ship the thing, I better order it now so it's here four days before I need it or a week before I need it". Before they would be scrambling at the last minute cause they forgot all about it. I think it helps subs, I think it helps us, and then once you get people to buy into it - I've had guys come back to me after and say "wow, we've made a lot more money this way. I thought you were a knuckle head from the beginning". They would agree to it. There has even been a... we did a school project in... I left and another guy took over and he wouldn't do it as much as I did and the plumber at the end... If I need to be up somebody's butt, I'm gonna be

up somebody's butt... but the project manager and I worked together and we got into a couple of confrontations with the plumber about stuff until he got on board with the program and whatever else and at the end of the job they were talking about change orders and he was like complaining on how he didn't make as much money on whatever part and the PM goes "but you really had John here yelling and screaming at you..." He goes "he only yelled and screamed when he needed to and you know what his job was dialed all in" and he goes "we were the most productive I've ever been on my projects". I don't know anywhere else, but if guys don't make money on your jobs – that would be the last thing they'd say "hey, can you do that over there for me..." But if they made money and whatever else and you go "can you get me..." "yeah, no problem" and they would just take care of it. There is no picking with extras and changes and there is not a lot of picking at other certain things because of it's more about getting people involved and giving people ownership is huge. Most trade guys don't think that anything they say matters, so it's like if they can feel like they had a part or a plan in it – then, they take ownership and make it happen. But if you ram something on them, they'll never gonna buy into it.

- 8 What reaction would you say was common among your closest coworkers when Lean was implemented?

[15:15] [How did you get your guys to commit to it? Were they like you "this is crazy, we will never gonna make it"]

Yeah... On that project when we first started – we had seven building going on at once and there would be... we started by breaking it down by unit, and by task. The first three or four weeks that we would sit in the meetings... and I told everybody at the beginning, because Anthony goes "they don't put any effort in, so you're gonna be there for a long time"... yeah, yeah, yeah. The first couple of meetings we were there for four and a half hours long just to get through the damn schedule. The subs are about ready to kill me, "half my day is gone" "I've got to go out and check on my guys" and I'm like "nobody is leaving until we agree on this stuff".

[36:40] [So, what reaction would you say was common among your co-workers?]

Younger guys were all for it. Because, you know – they'd seen some of it in school or whatever else. Younger people are a lot more likely to change than the old guys that are set in their ways for 20 years. So, I mean, there was some resistance. [So, it wasn't only you?] No, it wasn't only me. I think a lot of the guys that had resistance to it... I guess, me, Fred, and a couple other guys were the first people to really start using it – religiously. Cause Anthony was making us pretty much. I think once they would hear it from us, "hey you know, I thought it was kind of hokey in the beginning – but it really saved me this, this, and this". This is personal experience like anything else, if you work with a colleague and they've done something "you should do this, it really works for me" you are a lot more likely to try it than just doing on your own.

PART 4: ORGANIZATIONAL TRANSITION

- 9 How did your company announce that they would introduce Lean? **[40:26]**

We usually have a coordinating meeting for stuff like that and then everything that is getting rolled out like that, like new policies, procedures or whatever – usually rolls out one of those and they had a basically a little session on it. Anthony had a little presentation. [This was before they tried it?] We kind of... When it first started, he brought it to me and I said "you're nuts". He didn't get the commitment from the fieldsmen that he thought he would get. So, he was smart enough to realize that if he gets Dan and Chuck's input and commit them into something... So, he went the opposite way. [So, first he talked to you guys?] Mhm, he wasn't getting where he wanted to go, so he went the other route. [And then the meeting?] Yeah, he was like. This is what I've done before and all my home stuff... and this is what I think we should do... and we were like "no, we're not gonna do that". He wasn't getting the response he wanted. Dan and Chuck are very smart individual and he can explain what the benefits were – then he started to get commitment from them and it's a lot easier if you got Dan and Chuck going "Hey, this is what we're gonna do". I think he was very smart in the way that he handled things. He was kind of on a roadblock and he kind of took a u-turn, circled around and took the next exit and the next thing he's back on the expressway again. So, it just took him a little longer to get where he wanted. But, I think he got what he wanted.

- 10 For how long was the decision to implement Lean discussed, planned and processed before an actual implementation? [42:32]

It wasn't that long. Because when we kind of got the commitment from Dan and Chuck then he kind of came back to everybody and said "this is where this is heading, so guys might as well get on board". So, we are all smart enough if that's where we are heading we are getting on board. So, we had a couple of project that we had started that way and I think it was basically... I would say the main part of it, one of the first phases where we had seven different building going on... We never missed a closing on any other building. We were never late on anything and we had all that planning and whatever else. At that time, we were 4% higher than any other jobs were making at that time. So, that was probably the bigger factor when they could see the percentage and the profit. It's like, when you can show that to other PMs or other... cause nobody wants to have a crappy job. Everybody wants to make money. So, when other PMs and Superintendents can say "okay, there's more work upfront with the phase meetings and the other stuff... but, look at the benefits at the end". We started to get a lot more people that would call me up and "my project manager said I gotta do this next month, how do you do this...?" So, I was like... people were picking other's brains in the beginning and stuff like that. I think, one of the better things is that now... when we kind of rolled it out there was like everything else: you roll it out and you're not a 100% sure the aspects of it, things that would change over time period. But, part of my company's philosophy is that they basically let us choose how we wanna do things. We got rapid teams for everything. Dan and Chuck listen to what we say and can't change it. That's what we said in the beginning "we want you guys to do this, this, and this..." We have all this teams to process things "me, and a couple of other guys raised our hands and "but what happens if you don't like it? We just did all this work, and you're gonna vito again..." and they said "what if we can't vito it? Whatever this committee decides is FGH law?" We said "Okay". So, we are on our third or forth rapid-action team... first was Project Documentation and stuff, cause we had four different divisions. Second one was Change Management, change orders and stuff like that, this one is Scheduling and has a lot to do with six weeks schedule, another thing rapid action team is involved in... Edward, Anthony's right hand man, he's heading that up as well. All across it's getting implemented. It's just been to the point that it's been around long enough that people definitely see the advantages of it. Financially, schedule wise... everything.

[How long have you done the Rapid Action Team, is it a new thing?] [46:20] *Yeah, it started about a little over a year ago... When the team is done with a topic we need to do a presentation in front of the executives to show them what we've come up with before we roll it out to everybody else. Mine was Change Management; it was all about extra tickets. When I first came here, one of the things on the Superintendents sheet was... you're looking down on all requirements and whatever else and what you're responsibilities are and what you're able to do and whatever else and one of the things was basically that your signature on an extra ticket doesn't mean anything. I go, "I'm not taking the job" – it was my second interview with Dan. Fred was a general Superintendent at the time. I interviewed with him first and then with Dan. "So, I won't take the job because of the line right here..." "What do you mean?" "That's your signature for extra tickets" "I know" "No, as a Superintendent you got your word and your integrity and that's it. I'm gonna be the first guy who makes them do what they are supposed to do, but I'm gonna be the first guy to sign a ticket when they legitimately owed something." I said "I won't work for you if that's on there". "Scratch, rip" (sound effects). He initialed it and I did, and moved forward. But, in the rapid action team – part of the Change Management was I had a lot of Superintendents with health care projects and it's a big umbrella job. It might be five, six guys underneath it. They can't sign their extra tickets without bringing them to the head guy. Well, if you're responsible for the schedule, you're responsible for the subs, you're responsible for the profit, you're responsible for everything else, why wouldn't you be responsible for signing your own tickets. So, that was my big thing that I stuck up for and all project managers were "no, no, no". "I'm not budging on this one" and Edward goes "I'm gonna over rule you, cause I think that the old way was the right way" and I raised my hand "yeah Greg, what's up?" I go "do you remember in the meeting when we asked the question about over ruling stuff? Your vote doesn't count. You might sign my paycheck, but your vote doesn't count. The twelve people in the rapid action team decided that we're gonna do it this way – so, that's how we're doing it and that's what all you guys agreed to in the beginning". He goes "You're right, I did. Okay, next question." But it's like you know, for us it's a little different. I've never worked for a company that spent money on technology that we did when we went into recession. Everybody in the fields had Ipads and this other stuff. I mean, the*

technology with our own company that they have spent making sure that we didn't have down stuff or whatever else. I think we are a little different because, I'm not sure why, but there's just a little bit more of a vision between those guys... I've worked with a lot of companies that... they are only worried about this year, maybe next year. These guys are worried about 10 years from now and they have been since I started. Because when I started I remember when rolling out the first action plan and by this time we're gonna be here and by this time there and they've hit every goal.

11 What type of training did you get as the company decided to become Lean? [50:44]

Yeah, when we first introduced it and Anthony had gone to the Lean seminars or whatever they are. I don't remember where it was, but he went for however many days... there are a few people that have gone to those ones. When they came back, every Superintendent went to a, I think it was a two or three day class, up north somewhere. It was all on Lean principles and you know the push/pull and all that stuff. [Was it useful?] Yeah, it was because when you just think of certain aspects of it – you're not thinking about the big picture... Getting the stuff there just in time and you know, things like that... I would never thought how much of an impact that has just by having extra stuff lying around when you don't need it. But, when you have to move it 40 times...

11.1 How frequently did you receive Lean training or at what interval? [52:18]

No, I mean we've had smaller committees and stuff... Once we developed the six weeks schedule or whatever else... updates used to be a pain in the butt, we've done a few things to make it easier... Me, Edward, and three other guys – we have a meeting tomorrow, we are part of the IT-whatever you wanna call it. We are coming up with a FGH app. It has the six weeks schedule built to it, the daily report, a bunch of different things... if you have your six weeks schedule, check a box and it automatically get pushed into your daily reports – you don't have to fill it in... There's a lot of people that have been complaining on “no, because of weather” or a “no, because of...” which is out of my control. They have come against me. So, we have come up with six or seven M1, M2, M3... and when you click the “no box” and if it's because of weather, it automatically gives you the option to reschedule the next available day, a certain day, whatever... we are way, we have some younger kids that are so into the I pads, with the technology that's out there... Basically, all my daily reports, my safeties and all that stuff is on the Ipad and I can take pictures from it and fill it all in before I get to my office.

[So, if you didn't get a lot of training. How did you get into Lean, how were you taught?] I think construction in it's whole is, most construction projects are “what? Get it done the fastest way possible, right?” and then what do you throw in there – my obstacles, a few other things in there. Basically, what I just took was my trying-to-ram-it-down-everybody's-throat and use bits and pieces. I think it's like anything else – there is some sort of general template and you kind of take that and a couple of parts of your own style of doing things and you're kind of mash it together. That's how I move forward doing everything. Pretty much for me anyway, it was pretty much... I had the basic concept and I had a few classes with Edward or Anthony or if I had something on the schedule and they go “why this waste? Why are we doing it this way?” and I'm like “okay, okay, I get you”. It's been trial and error on a lot of stuff, but for the most part construction – you want it to be as Lean as possible anyway... so you're already kind of thinking in that way. It's just all the little things you don't think about... your deliveries and stuff like that. I think it's just once you get into it, it's just kind of naturally... I mean, for me it did anyway.

12 How would you have handled the transition to become Lean differently? [56:22]

Yeah, It's like anything and the biggest complaints I've had from most companies is that they roll a lot of stuff out. They talk about it the first couple of months, but after the first couple of months it's kind of peers out after that. I think if you gonna do something like this, it's gotta be gusto at the beginning and it's gotta be full follow through. Cause, you'll get people to pick it up eventually – but I think if we would have had... maybe more construction specific training. The Lean class we

went to was people from factories, so it wasn't construction industry based. So, there was a lot of question that didn't concern our field at all. So, if I would do it again differently – I would pay the extra money for some sort of training that is basically geared for the construction industry. Cause, there's a lot of things like people who work in factories that were bringing up – I can't do it that way cause my job it's not the same like that, where you come in and you pull this lever down and you can probably do it in your sleep cause you've done it however long. But, I our jobs change so there has to be a little bit more flexibility and different planning. I would definitely recommend more training up front. Especially for the field guys, project managers get a lot more schedule Lean classes and they have a lot more stuff like that. Where the field guys, they don't know how to do projects. They still give their schedule to the PM and he fricking does it all. With me, I'm gonna figure this out. I felt it took more time to write a schedule, review and make them change it, back and forth 14 times – “well, I wanted you to link to this and this and this...” I'm so so in linking tasks, you can get really crazy with them and we got a couple of guys that are really good at that – they don't miss anything. I normally do all my tasks and then I say how I wanna do it and then he's like “alright, what do you wanna do?” and he'll sit down and just plug it in and link everything and in two hours we can have it pretty much finalized. That's the hardest part for the older guys. Computerized schedules and things like that because they're used to writing it out.

PART 5: TRANSFORMATION

- 13 Can you describe the turning point when you understood the benefits of implementing Lean?
[1:00:12]

I think, probably after you have... It took me probably a few weeks to realize that when you... Anthony was the first one I told “this thing isn't working...blablabla” and he sat me down one day and printed out a schedule that was from three weeks before. He said “Let's go down it”. “Yep, yep, yep, yep...” I mean, there was 95 yeps and 5% no:s. That was the point where I was “okay, it wasn't something you could wipe your ass with after the first week”. It actually is close. He even told me, cause we would keep 'em and then we would save them... “Just every once and a while, go back to something – go back. When you get to the end of this schedule's sixth week – go back to the beginning and see where you were and see how close you are to that date. It might move a day or two, but I guarantee it hasn't moved a week or two”. So you saw the results? I saw the results Pretty quick? Yeah... When you go back six weeks and look back at projected – I was always within a day or two. And I think it's part of it is when you're doing a two or three weeks schedule – you never go back and measure yourself. Because it's only a couple of weeks. Where on the six weeks you actually have something you can measure against and when I went back the first couple of times and “shit, six weeks later and I only lost two days and one of them was because of rain...” or whatever. Then, you can see the benefits and you start to believe in it.

[Was there an “aha”-moment?] *I don't know if there was an “aha”-moment, but it was like I said – after several weeks of being able to see what we were projecting was actually coming true and we weren't changing it 14 times to make it to that point.*

- 14 How do you think friends, family, and co-workers see differences in your attitude and perspective of work after Lean was implemented? [2nd 1:14]

They realized I wasn't stressed, yeah, if you got a job that is running fairly smooth – your stress level can be here, but if you got a job where everyday it's chaos – you're going home and your bringing that stress level home and your kid doesn't pick up his shoes or whatever else and your barking at him within a second. I would say that it helped my personal life as well just to be able to manage the stress. Cause, I'm a very passionate of what I've done. My boss goes “do you know what your best quality is? You're passionate. Do you know what your worst quality is? You're passionate.” Sometimes I care too much. I think that helps put other people responsible towards them – I'm not the one who is suppose to call everyone out every single day “are you coming tomorrow? Are you coming tomorrow?” It's the schedule, and it's right there. You get it every week and it's updated, and if you don't look at it- it's not my problem then. So, it wasn't me personally take on the responsibility of making sure everybody's gonna be there the next day. Schedule goes out and copied on the email. The email says, “if you don't agree with whatever, you got to whatever to call me up and tell me. If not, this is god for the week”.

[Are you enjoying work more now?] *I would say it's a lot easier to manage trades, and a lot easier to manage when something spilled out. Like I said, I can go back and I can show them. I don't know how many guys that would work Saturdays for free or a Sunday for free. Cause, I can prove to them that they didn't man it when they were suppose to, they manned it at the end – but, “if you did all the way through you wouldn't have to work this Saturday.” “You're right Greg”. That's hard to do, to get a sub to pay for his own overtime. As anything else, I have had it twisted the other way where he can show me his schedule and that he was held up by these guys – They gotta work that Saturday and should pay them. If that's the way it is – that's the way it is. At least they are smart enough to look at it. He's looking at his schedule and he's doing it.*

15 How did work hours change? [2nd 5:28]

I don't know if work hours changed. I wouldn't say that they really changed. [No more extra work or less?] No, no more extra... It just makes that was there easier to deal with and coordinate and if you do have to get into a tight situation when you gotta have something done – usually by doing it this way, you'll miss a whole lot. I have done projects where we have a 36 hours and I have scheduled it by the hour. Instead of my six week, it's a 36 hours schedule. It might only take two hours until next guy can start. We're starting it Saturday when they close and gotta be done and gone like magical construction elfs coming Monday morning when they open up. It's helped not only on big stuff, but even on small crazy stuff. By having to do it on a detailed level on the bigger stuff, your subs that your work with again continue to think that way too. I used to set up in the beginning of phase meetings... Me and Dan had heated discussions when... I would always wanted to send out my schedule of how I thought the project would be built. Give me your durations; give me any issues in sequencing and whatever else. Dan hates that, he doesn't send out a schedule. He send out a piece of paper, give me your durations, give me this, and then collaborately they'll make up a schedule in that phase meeting. I actually now, that I've been to one of them and saw it work – I probably do mine that way too, because of the fact... a lot of times is, like me, I've got down here “HVAC, 5 days – what do you think mr. contractor?” “Yeah, I can do that”. But he doesn't tell me that “hey, gotta have a conduit for the thermostat run before that. I gotta have the steel installed before that”. So, if you don't tell them anything – he comes up with his list, which is a lot more detailed than your list. Cause, he's thinking “how am I gonna do the job? I gotta have the steel, I gotta have the thermostat line...” Where me I'm thinking “Rough HVAC – dadadad...” At first I thought “You'll never gonna get them do that!” And he had a hard time at the beginning and he actually sent a guy home. He actually cancelled a meeting cause there were three people that weren't prepared. That pissed off everybody else in the room and you should have heard the conversations when the subs were leaving. “You better have your shit ready the next time we're here. I just wasted an hour of my day...” I've thrown foremen off of projects because they wont prepare. That's one of my big things “I'm giving you the opportunity to tell me how you wanna do it, you don't tell me? I'm gonna tell you and you might not like it.” So, if they don't want to take the chance and time to do the homework up front – it's kind of like voting, if you don't vote don't bitch about what happened afterwards. If you don't do your homework, you don't wanna put an effort into it up front – don't come crying to me later, cause you've got five days and I don't care if you have three other things you got to do that you didn't tell me about. “Figure it out, you've got five days”.

16 How did Lean change the way you communicate and collaborate at work?

[16:50] ...[So, even if you didn't fully believe it you actually...] *We made them stay and I just told everybody “here's the deal, moving forward – this is what's going to happen, so get onboard or don't come to me later when I tell you, you gonna have to work overtime... cause I'm gonna be able to prove to you that you weren't in those units on these days and you're gonna end up working Saturdays because of it. I think, once you got... I think it's easier to get like, some of the bigger trades involved – because they know how the other guys affect each other. It's hard getting the painter, the security guy, the audiovisual guy, to buy into stuff like that... A lot of things at the beginning... we kept track of the PPC and everything, and we would give gift cards you know? To whoever had the highest PPC. Let me tell you about motivation within the trades, T-shirts, gift cards, and hats – they are the best motivation. For a five dollar hat, or a ten dollar T-shirt... It's amazing what guys will do. We started to make it a competition. This young kid that was the foreman for the electrical company and he's like “Greg, I'm getting those Home Depot cards”.*

Every week he was one of those guys that was always on top of everything. He was always waiting on somebody else. Every week “50 dollar gift card to Brent”, “50 dollar gift card to Brent”, “50 dollar gift card to Brent” and after about the third or the fourth week people started to get pissed off. “What do we gotta do?” “Start doing what he’s doing!” He gives me duration, and he tells me he’s gonna be done in three days and he’s done in those units in three days. The more check marks you get – the higher your PPC will be... I remember at a pint when... I was at that job for 39 months... I remember after about 12 months, we were just about to finish and complete phase one and begin phase two. Most of the subs had gone over from phase one to phase two, but I remember a meeting and we were talking about PPC. Brent goes point one percent higher than the plumber and then they argued with each other “well if you would have got done in that unit, I would have gotten this done” this and this and this and my percentage would have been better than yours, it should be my gift card then. The competition that it creates. Face it, 90% of the guys are guys, and what’s our mentality? We want to be the winner, we want to be the guy at the top “I will not let that electrician show me up because he’s got 96%. I’m gonna do better and get 97% next week” or whatever. For the most part, that becomes their mentality – you get the workers who could really give a rat’s butt, but for the most part – those guys want their jobs to come in on time and they want their company to make money, cause then they’ll get a better job next time or a bigger job to run next time. If you can create the competition I found that that is the easiest way to get trades to buy into it. We’re guys, we’re competitive. It’s in our nature, it’s in our freaking blood... That is probably the biggest thing in part of our success. It’s been because PMs like Anthony, I’ve told them “I’ve got to have rewards”, “what do you mean?” It’s like a safety program, if you cram everything up everybody’s ass “you gotta wear hard hats, steel toed boots, you gotta do this...” and you never reward them for being safe – what’s their incentive? But, you know what, if it’s by the end of every month – we got zero lost time injury and I have one hell of a pizza party, I buy subs or whatever for ‘em. That goes a long way, people work extra hard to do that kind of stuff. Competition and male pride has a lot to do with it to get people to kick in.

[2nd 9:42] [How did Lean change the way you communicate and collaborate at work? There must have been a before and after...]

Yeah, like I said: before when Dan was talking about it “Why do we do that, don’t give me all those crazy things... no, I want to keep them dialed in my stringy little pattern”. He goes “yeah, but your missing some key things that affect this” He goes “cause here is the bottom line...” We’re still pulling the milestones, those aren’t changing... So, okay if they just added three more things then the electrician, then the HVAC guy might have to decide. “Well, you were suppose to be done on Tuesday, I’m not coming until Wednesday... Can I start on Monday over in this area?” They start talking to each other... “Well, If you’re gonna be done in that area I can start there behind you... maybe three days after you and I’ll just keep chasing you”. [So, that meeting really helps in collaboration and teamwork?] Yes. [Do you hold those here?] No, normally if it’s a big job... when we were in California we had a doublewide trailer... When I have a phase meeting like that, we have our war-room in our office – it is a square roomed and everything above two feet you can write on the walls with marker paint stuff... Originally, when we first started it, we’d go in there and we actually list our schedule items and we brake it down into groups and then we put durations and then we kind of figure out the schedule as we did it. It was a lot of waste, so by having the subs prepare a little more up front and come in and “well, we can you do it in three days” “No, I can do it in two days” cause he already thought about it and it’s a lot less waste. And what I try to do is that I try to break it into a rough phase and a finish phase. I don’t want to have the painter there and sit for five hours when we talk about concrete... They lose interest and no one wants to do anything about it, so usually break it down to structure and below, and inside and finishes – so I have two meetings. The electrician has to come to both, cause he has trims... and the plumber does, but the painter isn’t stuck for a gazillion hours in some meeting that way. The more you can not make people sit and wait, I don’t know about you but I hate sitting in meetings, you’re not involved, you don’t have anything to say... People are a lot more likely to come prepared when they know it’s gonna be a nice efficient meeting.

[Did it take a long time to reach that point?] Yeah, it wasn’t like... The first few times I had meetings... Here, we’ve been doing it for a while so like I said – so we work with a lot of the same subs. So they’re used to it - they know what to expect. When we went to California they were like “what the hell are you talking about... six weeks schedule? And phase meetings?” I was like “Don’t you wanna have a say in how you do your job?” “We’ve never had that before”. So, I mean it was hard at first out there to get them to buy into it. The quickest guy was my electrician – it was like his bible. “We’re supposed to be here Greg”. When you can get them to buy into it, it’s

the best thing ever. When I was in the trades and hardly went to the superintendent, I just went "I've got a problem, can you move this and get your stuff done" – and usually you could work it out, if you can't work it out... then you go to the Superintendent. Nobody wants to be even confrontational with anybody else. I've guys at a ten-acre site in California, okay? They call me up and walk all the way over there... There are three piles of duck tape there "I can't do my ceiling cause this stuff is in my way". "The HVAC guys is right there! And you know that!" "Well, that's not my job..." "It is your job, read your contracts – it says 'coordinate with others' that means being a big boy and going over and talking to him" That's probably the part that is the most aggravating in newer construction. Nobody wants to be that... they want you to be that person. Well, when I'm walking around the job site I've got 15-18 subs on everyone of them. By the time I walk form one end to the other, I probably had 20 people talk to me at most times. I'm really good and I used to carry a little tape recorder, now it's my phone... Cause you get to the twelfth guy, you forget what the first guy said "Well, I told you yesterday" – you know what I mean? So, I don't do that stuff anymore – you're responsible for your own actions. If you need him to move something, you tell him to move it. If he won't move it and you two can't hold hands and sing kumbaya together – then I will come and solve it, until that time I will not get involved. Everybody is to quick to solve the problem. The best advice I ever got form one of the first jobs I ever ran was by this little old man that was a superintendent and the iron worker and another are ready to beat each other to death – arguing "you need to get out here!" So, I'm jumping up and put my hard hat on and run right out and solve it. He goes "sit the hell down" I'm like "What?" He looks at his watch and he goes "7:24 you can go out there" and I look at my watch... 7:04. "It's 20 minutes!" He goes "Exactly, they'll have it figured out by then... They will not stand there with six guys each and argue for 20min before you come out". I wait 20min and go out there and they're both working.

17 What professional benefits have you seen within the organization by implementing Lean? [2nd 17:01]

We attract better subs, cause they wanna work for us. We run a clean job, we run a productive job, they know what to expect when they are coming to onto one of our jobs. They know that they're no gonna, we're not cramming 40 guys into one area. We know that we're batch size accordingly and that we are doing things where everybody is productive. It gets us better numbers, cause we are more productive.

[There are two possible aggravations, one if you work for an owner that doesn't get Lean, the other is if you have a sub you've never worked with and they aren't doing Lean. How often does that happen and you're sort of training them? Are you still at that phase?] *For the most part, the majority of the guys in the division that I work in... I know Anthony has a little bit of a different thing – some of his stuff is public bid and things like that and they can't be as choosy. They have to take according to whatever it is... But, for the most part for our group. Most of our work is negotiated. So, we know what our numbers gonna be and they know what to expect. [So, you go back to the same people you've worked with before?] Like I said, we used... literally we have four trades for each thing. We have four different electrical companies we go to, same with the plumber, same with whatever... A good example is, we got a big project at Conroe, okay? They were looking at it, HIJ had all the drywall. IJK, they were more expensive than others but my boss said "it's still under my budget, go for it". We're not going back, beating them up for their bid... When I need something from them, I don't get nickel and dime neither. I guess it's the same thing on everything... If you beat the hell up out of your subs for everything and expect them to give you everything for nothing – then expect to get tickets. If you can work with somebody... there's been a lot of times where I just try to keep the field guys involved and not the office guys involved cause if me and him can work it out in the field, instead of going into the office and go "I gotta get approval for this...etc" Cause it all goes back to the tradesman again, you gotta give me credit for this... you gonna add this. And if me and him in the fields think it's fair – we don't say anything. We make it go away. I think it promotes more of trust. Face it, how many times have I been on a construction project and you ask the superintendent "when are we gonna do this?" "you'll have it Thursday". You plan accordingly, then it's a week from Thursday and you gotta try to find a way t put all those guys or whatever else. The more reliable that we are with our schedule, with how we do everything, it only makes it better for everyone. You get the buy-in. There is no questions.*

[And do you get more satisfied clients too?] *Oh, I think so. EFG, we've done six of those since we did that one... etc. If I would not have had the schedule I had, and had everybody... I beat it to*

them out there, “This schedule is god everyday”. It was that tight and the client was so particular about things... I think it only solidifies when you can make a schedule and follow it. People get that buy-in for it. Do you know how many comments I’ve heard at phase meeting when people “how long are we here for?” Cause I make them bring the foreman. I don’t want the salesman who got them the job or the PM to agree to everything because he thinks he can work it out with my PM... I want the foreman running the job and I want his durations. The best part is that whenever you have your master schedule the durations are always shorter compare to whatever it is. They always agree to those terms and I’m like “I could hold you with the master schedule... and show them “20 days!? I can’t do that! It will take me 40 days”. “Okay, work with me then”. I think for the most part all our subs are on board. We definitely see the benefits of it cause I mean it’s like when we first had these meetings everyone was like “erghh...erghh” Now you come to these meetings and guys have four pages of notes and all their shit dialed in. Before, they didn’t do their homework “well, you didn’t tell us about that”. They know that it’s part of the program now. It’s a little work up front, but it is well worth it at the tails end.

[2nd 24:07] [Have you seen improvements safety wise too?] I would say as far as not real safety issues – but like housekeeping, cleanliness... just overall access to the job cause you don’t have everybody trying to bring 3000 sheets of dry wall and leaving them in piles all over the place until two months later when we need ‘em. You can sit on them, having a break, sleeping on ‘em – you gotta move them 14 times. See what I mean? definitely on the aspect of it, cleanliness... it makes it easier – cause people don’t have shit piled all over the place. When I first started, we called the cabin guy and said “yah, you just set these four cabinets I want in this room” and the next thing you know he shows up with a semi-truck... “where do you want me to put this until I come back” “I don’t need em for another four weeks, nooo”. Then they wanted to stack them on site “well, I don’t want to move them four times”. “I don’t want them damaged and have to fix it...” “Well, bring them when you need them then”. It helps a lot on back charges because of that aspect. I would say it’s a very big plus, definitely... If we get this FGH App thing going – that will be phenomenal.

PART 6: IMPACT

18 Have you had someone mentoring you through this process of becoming Lean? [2nd 26:32]

Yes No

[Was there one-and-one mentoring scheduled?] It was one and one in the beginning and stuff and then later on it’s more of “hey, got this question, what do you think?” He has a vast amount of knowledge about that. In the very beginning, that was the only way he would get me to it. When I finally caved in, it was like “if I don’t stay on – it’s gonna go a couple of weeks and he’s gonna forget about it...” So, he was all over at the beginning and kept pushing and kept pushing. So, it’s like everything else – when the squeaky wheel gets the grease.

19 What advice would you give to future Lean implementing workers in the same position that you were in? [2nd 27:52]

I think the training up front is important, definitely. If you’re not properly trained or you don’t have any questions about it – you’re just gonna throw it to the way side and you’re not gonna get it. The most important thing is after that would probably be commitment from their office – the high level management. People talk about it all the time, but unless those guys are pushing it as well, it’s not gonna... If Chuck wouldn’t have got involved to the level he’s got involved with this – I would say, probably 50/50 would be used... you know what I mean? Cause, a lot of the guys have tenant jobs – six-eight weeks only. Why do we use a six weeks schedule? That’s the important part of it – you don’t even have to update it once – you know what I mean. You just have to keep putting it up each week. It’s not like you need to keep adding on. I’ll do the six weeks for the whole job and I’ll do each area and I’ll do the whole job. I never like to go back... When I get into it, I’m looking at the drawing and looking at the job – I’m just typing everything in as I go. I don’t wanna come back later and think about it. I know most of the sequencing and whatever else, I plug t all in there and if it’s week 12 – okay, it’s get hidden for the first few weeks and when we first get to that point I’ll open that up and let everybody see that. But, then it’s already dialed in there, I already got everything in place. Somebody says, “you’ve changed it” “No, id didn’t change it. It’s still the

same". These guys are a different group of guys to work for. I've never worked for anyone like this ever in my life. I'm not planning to work for anyone else before retirement.

19.1 EXTRA QUESTIONS

[So, you got all this detail in the schedule. How do you add an activity? If you forgot something and later you remember, how do you add it? What happens if something doesn't go right, like weather?] **[26:09]** *It depends on the schedule. I mean, on a school job – when school's opening... yeah, you're gonna work more overtime or weekends to get back up. If there's not a hard thing – we're gonna finish second week in December, and we're going into the third week in December, if there is no hard date associated with it it's not as bad. But, in the last 28 years of doing this – there are not too many jobs where we have those hard dated deals. There's been "oh, we wanna be in this week... but when you get closer and you've got some issues of permitting, drawings, scheduling"... they're okay with it. For the most part I remember things not change too much.*

[38:00] *[So you were one of the pioneers?] Yes, pretty much. I really wouldn't consider it pioneering at the beginning – it was a little, you know, pain staking – but, to look back at it now... I can't imagine running like... I've been in California the last two years on projects. I did the EFG dealership. The big concrete one. As soon as we were done with that one, they asked us to come to California. We had 70 million dollars in two years out there, between the five of us. At the Beaumont job that we did, the number one EFG dealership in the country. They sell minimum 600 EFG a month. That's 20 a day. They are open every single day, except Christmas and new years. 420 employees, nobody parks on site. No deliveries after 7 o'clock in the morning. No employees parking on site. No this and no that. We had huge restrictions. So, if we wouldn't have had the schedule that we had in place – basically telling everybody where they need to be on every single day and in those areas and if it wasn't followed I had a million phone calls, I had a million emails. "Why are they here doing this?!" We gave the... We tried to just give the owner my version of the six weeks and they just couldn't comprehend it so I did bullet points – Monday, Tuesday... "here's the areas that we're gonna be in" but damn if we deviated from them, I'd be having a phone call or whatever else. So, it was very important to get everyone to buy into it. Otherwise, half of my day would have been managing the client and they were a very demanding client.*

[1:03:25] *[You're going back and you're looking at your progress. Let's say you're in week one, you're doing the work, do you physically go out and walk everyday? How do you document?] Everyday, what I normally do in California I had six six weeks schedules because we had six different portions and it was the only way I could keep track. I would have them, and they would be printed, and I had a clipboard. Normally, how I make my six week schedule is how I walk the building. After the first week, I know how I am walking the building. If it's a high rise, top-down, or other... If I walk it, I walk it the same way. That's where I put my tasks in so I don't have to go and I have to skip all the way o the bottom and check of this, this, and this. I build my schedule of how I walk the job. I usually walk twice a day. It's make everybody accountable. I have to be just as accountable as them.*

[2nd 4:22] *[When you do your pull planning session, everybody who is in that phase is gonna be there, right?] Mhm. [But they are not always there for the six week look ahead meeting, casue they might not have any work in that six weeks?] Correct. [So, let's say they there for the seventh week, they are not quite on the schedule yet – are you still sending them the schedule every week? So, that they can see the work that is progressing?] Yes, normally when we have subs awarded – just because I try to do it the other way before, and I'd only send it to the people that where work was happening. I inadvertently missed somebody and he would use that against me later – so, my philosophy is: If you're not on there – delete it, otherwise you're getting it cause then you have no excuse to tell me you didn't get it. Everybody always gets it and I think most of the guys that have worked long enough with us now, they just*

automatically... if they know that they are not within that first six weeks – they can just delete my emails right away without even look at it.

Appendix D

Interview with interviewee D, a 48 year old Superintendent who implemented Lean about 3 months ago.

PART 2: PAST IMPLEMENTED SYSTEMS

1 Has your current company previously tried to implement other continuous improvement systems than Lean? [11:25]

Yes No Don't know

2 If yes,

2.1 What system was implemented?

No, not necessarily before. ZYX was a company before Pull Planning; ZYX was in the process last year of changing the guard. The dad, Anders, was getting older and the daughter, Angela, was taking over and she's very rustle, very hands on. There was no silver spoon there, she's a sucker punch and she's very good at what she does. She's been improving the company so much. She's been doing it by using outside resources. Before we always used ideas inside the company, we always asked the smart guys "hey, what do you think about this?" Well, pretty soon you use up those inner resources, you've tapped all you can tap. Angela knows that.

2.2 What was successful and what was not? [12:16]

She decided to look around at other growing companies and see why they are and everybody is using outside resources. It's becoming a whole industry what you guys are doing. Not just Pull Planning but every single facet of it, from safety to... Everything is outsourced now.

3 Did you hear about Lean before your company mentioned that they would implement it? [14:37]

Yes No

4 If yes,

4.1 What was your perception of Lean at the time?

Superintendants have a network and we talk to each other. I know superintendents from other companies and they'll mention it, you know? "We're doing this Lean thing now". [Anything positive or negative?] No, everyone I talked to was just getting into it. It's not like they were all doing it for a long time. It was new to them as well... Angela is really smart; she didn't go to the older guys – the dinosaurs, because they would have just agitated that right back. They are set in their way. She didn't go to the too young guys, because nobody would watch or follow them. So, she took the middle of the road guy – average Brad – I'm not computer savvy, but I get around you know? I email, do word, and excel and all that. A little CAD, so she already knew I would accept it. She's really intuitive. As soon as she heard it she "Okay, Brad..."

PART 3: INITIAL REACTION

- 5 When you were first introduced to Lean at your company, would you say that you immediately supported Lean efforts or were you somewhat skeptical?

[16:05] [What was your reaction when she approached you?] *“Yes, mam!” There was no other reaction than that. “When would you like me to start that?” [How were you so easily convinced?] She said there’s gonna be a man, Conny, contacting you and you gonna start doing your pull planning sessions, contact the subs, contact the PM’s, make it happen. [More like an order?] Well, she never ordered. She just said “I would like you to do this and we would like to start it at this job”. The reason why we started it on the job is because of the type of job. It’s a rehab. When you build buildings out of the ground, we mostly do high risers – my last one was 65 stories. The reason... when you build a high riser out of the ground you build from the bottom up and then when you get to a typical floor it’s kind of cookie cutter, and when you get to the top – it’s a little different, but then you top it off and you’re done. A building like this you have 27 stories and you start working on every floor the first day. You’re working in the whole building and you just... your mind is, you know... It’s a complete blow up of the brain. But I’ve done this. I did the exact same thing, a 100 year old building, 20 stories. So I already knew the job. They all wanted to say “since you already did this job, we gonna do this with Lean or with pull planning and we’ll see...” They wanted to use me, to see... Everybody talks to me now and Conny loves me cause I keep giving him guys to call. But, I told Conny, and I meant it from the bottom of my heart that I will never do another job without it. But, from now on I will do it from day one. We were here, already started, so I already had the foremen go in one direction and all of a sudden I said “we’re doing this now”. It rattled them for a minute.*

[For how long will this project go on?] *Till next June.*

[19:10] [Would you say that, because of the type of project you are at, a remodel that made you more ready to get on board with this new concept?] *Yes, myself as a superintendent before anything of this... the scheduling was one of my hard spots. It was one of the hardest things for me, because we have to commit to so much stuff and once you commit there is that waste we talked about. Three is three guys that are waiting a delivery. I told them “you can deliver here” and now they can’t and “awww”... and with a 20 stories building and the logistics I have here - it is ten times as hard. So, as soon as they said “we’re gonna bring in someone and this is gonna help you schedule”. I said “bring him, his brother, his cousin, bring ‘em all.” That’s why I said I want to use it on every job from now on, because the idea is you get the whole room to think about a problem instead of me thinking about the problem and I can pull from their years of experience. I don’t have to figure out plumbing in my head, cause I have a guy that has been doing it for 40 years telling me. And I have the ironworkers that have been doing it for 30 years telling me and the carpenters and pipers... Now, I can use a consensus very quickly. We can all discern, what’s good, what’s bad. Cause, someone is gonna speak up immediately where the road block is. We can’t do that, it will be in my way. I wouldn’t know that schedule by my own. So I use the force, I tell them. We call it the force. [In other words, they are not mad at you cause you scheduled wrong?] No, actually they are all on board now. This way, they buy into it.*

[How long does the Pull Planning sessions take you?] *1.5h.*

- 6 Who or what influenced your attitude towards Lean?

[21:50] [Influences would be Conny and Angela? Who influenced your attitude towards Lean?] *Conny, actually did. I mean, I was told by my company to do it, so I was going to do it regardless.*

6.1 In what way did these people or events influence you? [22:05]

I told Conny “you have got to swallow these pills, it’s better to smile while you swallow than frown, you got swallow it”. So, get on board right away and make it work. The longer you push against it, the longer it’s gonna be.

7 What arguments were you weighing against and for Lean? [22:37]

The only thing that doesn’t work for me that seems to be a staple in this is... Conny wanted me to get the guys together every morning at 8:30 and go over the previous day and mark it off. I have such limited access to the building; I have to skip out of my building. These guys need to get their men out and need to get them work and then come back down. I couldn’t do it, I tried to do the 8:30 thing, but it wasn’t working. I have too many people at too many places. Actually, I walk the building so much that I know what’s going on so I just to the board myself and I look and I see who’s doing what “yes, this is getting done”. Whatever is not getting done and I don’t already know why, then I just call them on the phone and “hey, you weren’t up here today and you were suppose to get the beams in at 14...” “Well, I couldn’t get the...” you know what I mean, they will give me whatever reason and then I will be able to juggle. But I don’t touch the board. We wait for the next session and then we pull the dead ones over. [So how often do you do...] Every Tuesday, once a week. [So, the only negative was that daily meetings aren’t possible?] Yeah, and I think because of the type of job I’m on six weeks is almost too far out. Only because of everything that comes up so often in a rehab. It’s different. New construction, you know what’s there because you’re the one putting it there. So, you can schedule much better, much tighter, there is a lot less unknown. [You’ve mentioned a few positives with Pull Planning...] They are all positive, the only negative I have is that I don’t have enough time to do more of it.

[Are you the only one doing Pull Planning?] *No, Drew – our superintendent at the one next door – he just started – and then Elliott start next week or the week after, as soon as his job starts.*

8 What reaction would you say was common among your closest coworkers when Lean was implemented? [24:50]

Most of the time they’re reserved until they see it. They are not exactly aggressively averse and they’re no jumping up in my arms for a hug. They just “what is it? How does it work?” you know. How I got Drew and Elliott involved is just that I called them up and “hey, common over and let me show you what I’m doing” without a session going on, just by ourselves. I said here is what we did. “That might work, yeah, that might work” I gave the Conny’s number and “give this guy a call” and then they start. I know those two guys, that It’s gonna help. I happen to know these guys, I know their attitude, they fram of min and how they work. You plug that into them and they’ll run with it. There are a few that I know would be adverse because they are the older plan, or the dinosaurs. They are averse to reading an email cause it comes from that box under the desk and they don’t want to hit the buttons and you know... It doesn’t mean they’re less good superintendents. They just have a different management style that they were raised with for 50 years.

[How fast did you see positive feedback from Pull Planning? Right away?] *Yeah, you see it right away. Well, you realize the benefits from it right away. Because you see everybody piling on. You see the enthusiasm, it helps a lot... I have a good group of guys, so it helps a lot if you have a receptive audience. If your audience isn’t receptive, then you have to convince them and Pull Planning will convince them – it will just take a couple of weeks. You can’t discard the truth, you’re gonna see it. It’s right in front of you on the board. They can’t get away from it, it’s not an opinion. It’s what’s happening.*

[47:26] [You seem very enthusiastic and it’s very encouraging to see – do you feel like your workers also embraces that, that they can see the positive benefits that Pull Planning has?] *Yes, unfortunately it is just the foremen and then I have to rely on them to trickle it down to their men. That enthusiasm already took a beat, but the men don’t need to know every facet. They need to know where to put that piece of pipe and the foremen can do that. So, as long he*

is in our group and has our consensus to direction, then he can very easily tell the guy. The best part is for each individual foreman, it's not good for me – it's for them. They know now that they need seven guys today because this much is going on, but they only need three guys tomorrow and twelve on Friday. Instead of having twelve here all week, the old saying is "I'll rather have too many than not enough", but that doesn't apply anymore. Now, you know what you need. Which is part of that waste thing, part of that schedule thing. They make money, which means – I make money.

PART 4: ORGANIZATIONAL TRANSITION

9 How did your company announce that they would introduce Lean?

[27:50] [When the company announced that they would introduce Pull Planning they talked to you just one-and-one. Is that how you were introduced? Or how did that happen?] *My Vice President Flynn... Angela doesn't always talk to me, she talks to Ken and Flynn will complete her wishes. But, I know it's coming from Angela cause I'm talking with Flynn about it. So, Flynn said "hey, we're gonna try this thing. We think you'll gonna be the best shot at it. Help us out here, get these guys involved and see how it goes and report back to us. If it works, it works, if it doesn't it doesn't. We got to do something." I said "okay". He said "it worked everywhere else".*

[Would you say it's not fully implemented in your company?] *It's not at all implemented in my company. We are starting it. It will be! I'll see that personally. After I was seeing how it was going, I went to our general field superintendent and told him "this is what we gotta do". He's is every superintendent's boss.*

[29:23] [Did the company introduce Pull Planning to other people than you at the same time?] *I was the first, they wanted a toe in the water to see, you know.*

10 For how long was the decision to implement Lean discussed, planned and processed before an actual implementation? **[29:47]**

No, I don't know the "behind the scenes", for how long they talked with Conny or if Conny was even the only guy they talked to. Knowing these guys, they are very smart, they probably talked to three or four different consultants and decided that they liked... actually, I didn't even know about Conny... First it was the other guy, Gilbert. They were equally knowledgeable...

11 What type of training did you get as the company decided to become Lean? **[31:08]**

Conny came out and he had his slide show. He said "here's what we gonna do: get all your foremen in a room and then I'm gonna have you pull this piece of schedule. We're gonna work backwards, we'll figure out constraints, then you'll start to see how any decisions from the developer, the designer, the owner, are gonna impact your schedule. We're gonna put them up there for everyone to see and one other thing that we do with this is: we have always see meetings once a week on Thursdays. Owner, architect, and contractor. We just happen to have that meeting in the same room that my pull board is on. So, as they are having their meeting – my people, that are not part of Pull Planning can look up and see what's holding me up. So, all the truth is being told. "You guys need to hurry up here", "Yes we do, and as soon as that is answered – we are able to do that for you" and it works the other way around – it works for the owner as well. This is not an one-edge sword. If I'm screwing up, then they can look up and say "your guys should be done there and he's not, we want to know why". It helps both sides, it equals out the playing field – because everyone is involved. I have an owner rep at our Pull Planning sessions, and one of the direct owner's representatives there, and we work for the developer – but I want the owners there. So, I keep the developer out of there – there are the owners and us. So, it works out real well. This thing on the wall is like a

third party at the meeting, you know. It helps. And they should be part of it, because I want the owner to see how it's going... Instead of just walking the job they can immediately go to the board and look at the board – call the owner and say “here's when you gonna have this, what has been done, here's what has not been done and why...” In 30 minutes, they sound very intelligent at that point. They sound like they know their job very much and they are standing in front of my pull board with my stickys on.

[So you had this slide show from Conny and he talked to you what it meant to do Pull Planning – have you had any other type of training?] *No, that was it... and then he came up for the first two sessions and he made sure that my focus was correct. Because, I've never done it before. He introduced himself and the system to the men, he segwayed, and then pulled me up there. I knew the field, I knew the guys, and I knew what was going on – so he segwayed the meeting and then I went up and took it from there. That's how it made sense.*

11.1 How frequently did you receive Lean training or at what interval?

[34:28] [So, have you had any other frequent training sessions with Conny?] *No, he came back – we did another Pull, because my first Pull my steel was crashed. So what we did was, a re-adjustment to the schedule, and we re-Pull Planned real quick. I didn't want to use the word recovery schedule because the owners might use that in a court someday.*

12 How would you have handled the transition to become Lean differently? [36:00]

No, he did it really well. He told me everything I would need, he told me what I needed to bring as far as the sticky notes, the sizes, the big pads, the little pads, and the boards. So, he had me prep for it really well by and by doing that I saw where he was going with it. Then he gave us the orientation and I knew where we were going with it. So, I was basically ready for it although it was new to me. I'm not an idiot so I knew where we were going with this and as soon as he started it, I saw what was going on and I just jumped on it. Since I had that heads start, that was better that I went up right away – otherwise they wouldn't have had a heads start. So, once they saw me accept it and run with it... I think that if I would have resisted it, I think there would have been a lot more resistance. Only, because in the trades and in the fields – it's all a leader thing. They rely on me on safety and everything else so, they trust me... they see me backing up, they already know there is a reason but they saw me digging and go so... “Follow him!” A really lucky thing for me, we use the best subs... So, we're using the best of best and I get the best of the best...

PART 5: TRANSFORMATION

13 Can you describe the turning point when you understood the benefits of implementing Lean?

[39:05] [How fast did you buy into this?] *I bought into it right away, but saw the results two weeks later. A lot of it was the concept of a result, I already knew what I was gonna see – my min works with projections. I always know what's coming at me, I don't know... That's why I have my job. I look out for weeks even though I'm acting today. In construction, the owners are always looking at the next year. This year is dead to them... So, our PMs are always looking at six months. I always look out two months, my foremen look out a week ahead, and the guys that work day-to-day – they look out for the day. That's what they are paid for. They are paid to come today and I don't know if they are coming tomorrow. I'm used to look that far ahead that when I saw... it might only be a bud, but I saw a blooming flower right away.*

14 How do you think friends, family, and co-workers see differences in your attitude and perspective of work after Lean was implemented? [40:45]

I am more comfortable with my decisions, because there is more of a backup that I can rely on. Before I was relying in assumption and now I'm relying on guys who have been doing it for so long. So, it's kind of a confidence booster. I'm more confident now with my schedule. I've always been over confident with my abilities, "I'm the best advertiser..." I keep a halo in my pocket and have to put it on now and then... I've always had a confidence problem in myself and in what I do and... I never want to do a bad job. It's always been... that's one of the things why scheduling has been so bad because that would be the first place that I could let someone down. Psychologically, that has always been my bad...

[So this new way of scheduling has been a very powerful tool?] *Yep, especially for me. It's my worst performance. So, it's a great leveler.*

[42:51] *Do you feel less stressed now because of the scheduling? Yes, I feel less stressed out. I don't have an umbrella in my drink, but I'm feeling more confident. That's the word I gotta keep using, I don't now why but that's the way it is... Schedule is the money, I don't care what anyone tells you. I don't care what anyone tells you. If I could be the scheduler, I could make money. Our GCs are phenomenal. Our General Condition costs are phenomenal. Everyday, a crane is on the job – it's 60 grand or something ridiculous. There's a lot of money everyday we are on a job. Everyday I can shorten that job, I not only have made more profit – but I shortened our expenditure and that is actually better than profit if you're looking at ratio. If I could get out of there quicker, whether they make their percentage on the gig or not, if I can get out of there quicker – it's like doubling it. 60 grand a week... that money adds up very very fast. Now, opposite below that schedule - you stay an extra three months, you've lost all your profit margins and now you're looking into the company's own tank. You'll be a superintendent as long as Harry takes a deposit slip at the end of the week and not a withdrawal slip to the bank. As long as he puts money into the bank, you'll stay here.*

15 How did work hours change? [42:07]

Again, I'll use my projection. I know how it can, this job is not a good way to emphasize it – because, this job is just like walking into a fire. It's just terrible. So, this isn't really – I told everyone... I can't wait to start a fresh job with this. I want to come out of the gateway.

16 How did Lean change the way you communicate and collaborate at work? [44:54]

Communication hasn't really been a problem with me, because I'm a vocal person and I'm direct. Especially with the guys, but now everybody knows what I'm talking about when I ask 'em stuff. At a normal job without Pull Plan I'll schedule something like plumbing with a plumber, we'll go over the schedule together... and then if I would walk over to the steel guy and say "listen, the plumber get the pipe up at his chase"... "When, what, where?" Now, we are all in this big circle tighten a big knot and he already knows what I'm talking about because we already spent 45min talking about it...

[Are you more team oriented now?] *Yes, very much more team oriented... When you do Pull Plan there are thing you need to be ready to adjust for and that is "nothing is static", you'll be half way through a job and they will pull the plumbing foreman to another job because he's better suited and now they're bringing a fresh guy and then the next day you'll lose your three good electrician because...you know what I mean? The good part is that everybody else already bought into it and he doesn't want to be outside, so he's looking around and "yeah, okay". If everybody would resist it, the new guy would be resistant. When everybody is going, he doesn't want to be the anchor. That's why you need to keep that flow going, the momentum so to speak. The men need direction. They yearn for it. So, if you give it to them – they'll take it.*

17 What professional benefits have you seen within the organization by implementing Lean?

[48:58] *[Have you seen any improvements of safety?] I haven't seen a direct correlation to safety. Again, using my pro-reading mind, my looking-out-mind, I know how it will. I just can't quantify with a direct result. I know how it will. This whole industry is changing to safety now to where it used to be the opposite. I hear now that I work for a safety company that has a construction department that I'm involved in. That's kind of our attitude now, when it used to be each guy was directly responsible for the safety on his job. That didn't work out to well. We had low numbers, so we often ran to outside consultants for that. We hired outside the company for our risk manager and now everything is changing and we are doing great on safety. We are one of the best in the city now with safety... Less people are getting hurt, we are getting sued less. I keep saying that we save money, but it's our job, we don't want to see our men hurt. I would rather keep them around for the next job than you know, we can't just replace them – they are men. I can tell you right now, it's the director – how he perceives it is how we gonna take it at the job. It doesn't matter how great Conny is, he's not one of them... I am one of them so when they see me or I say me, when they see the director, the presentator or whatever, then they will follow. I can't stretch that enough. [What you say is that you take knowledge through outsources and you implement it] – but it has to go through you and then it will work. Yeah, someone needs to heard that information, it doesn't matter how much information you have – somebody has to heard it and give directions and the directions hasn't changed, but the Pull Planning has helped me to streamline. Now I go to A to B, I don't have to go to drive through Memphis to get there anymore. I get right where I need to go.*

PART 6: IMPACT

18 Have you had someone mentoring you through this process of becoming Lean? [52:08]

Yes No

[28:50] *I'm a mentor, we have three mentors so when we get a new superintendent to the queue – they stick 'em to one of us to show them the way. Since I'm a mentor I said, "this is what we need to do". So now, when the new guys come on they'll immediately get it, it won't be new to them. They won't know if we started this yesterday or 100 years ago. They just now, when they come here – this is what we're doing.*

[52:08] *[Do you have a mentor yourself?] No, I was hired as a superintendent. I wasn't mentored, I pretty well knew my position and I was hired the old way – mentoring is a new thing.*

[Do you have a Lean mentor? You already mentioned it – you're first, so you will mentor others.] Yeah, I already told Conny that I would come over to help if he wants me to.

19 What advice would you give to future Lean implementing workers in the same position that you were in? [53:30]

I'm kind of a people person. I like people... depending on who I was speaking to is how I would go at it. If you're talking to somebody that is a straight cut-to-the-case... then I would give them the steps, but if it was somebody with a little wish-a-wash who didn't know – then I would hit them different. It's all in how you sell it. My idea is to sell it, cause it's gonna make our company more money. More money means more bonuses, I can't lose. So, whatever is better for the company and it sounds self-centered – it is not, but I'm gonna put it in perspective. The whole thing is better for the company, we just went through a hell of a recession, if we had this prior to the recession I think we would be a lot better of. Where I'd like to see Lean go is to the bidding. I know there's gotta be a way to make it to the bidding. Our bidders are kicked out of school not all of them, but most of them are younger and if there was a way to Lean back to the way they bid. [How do you do that?] I don't know, that's why... I'm not a professor at IIT... There has to be a way to do it, because there is so much waste in estimating and there is so much under waste – there is so much that is assumed and not

correct. It's wasteful, there has to be a way, it doesn't have to be a Pull Plan. But there has to be a way to judge... to help the estimators. That was the first thing, when I saw this working, I said and I projected it "okay, we got this, but they need it up there".

19.1 EXTRA QUESTIONS

[0:00] [How long have you been doing... so tell us what are you doing, are you doing Last Planner?] *I'm doing Pull Planning sessions, it's how it's described to me and so... how it was brought to me... our company hired the alignment to consult and I was the first one so Conny came and explained what he wanted to do and he and my boss, the Vice President told me what they wanted to do... they said to me "we gonna have a guy Conny stop by and talk to you about your job, using the Pull Planning session to help us schedule", okay, so they asked me how... and Conny said "the idea is to pull ac critical milestone into a schedule and pull back from it and then a s you work towards it – don't pick one that is too close to you in time duration because you'll hit it too quick and he said if it's too far out because the men won't be able to see the forest, there is too much in between... and in this business we talk about it everyday. I could have a schedule and I juggle that schedule everyday because this thing just happened. We hit utilities; trucks don't show up, three guys don't show up. You know, something happens – it's like a Rubik's Cube; you just flip to the next color. So, the idea is to just get the work done in whatever manner you can. I decided to use a critical milestone six months out, the drying in of my elevator shafts – so then I would have put a floor, the roof on the building, and be ready for the elevator guys. The reason I chose that is because by being ready for the elevator, so many things are ready then to proceed with. So that was a good milestone, that was six months out – which was another good reason and everybody I would be talking to, all my foremen understand what I was talking about drying up the elevator shafts. They all heard that... it's the same at every single job. They are already tuned in. I've got something they are tuned in for, and it's not too far out and it's something we can pull through. So, that's what we did. So, we took our schedule of our first day of class... we took our schedule six and a half months out so we put the big board on the wall and we put the elevators and worked backwards, time duration. Then we put up a milestone and worked backwards and what is that gonna take – ten days, but you can't do that before we put concrete on the roof, can't pour the concrete before the MEP are on the bars and until it's framed, until the steel structure is up... and we rolled it all the way back to that date we started at. [Who were present at this moment?] We had all the foremen inside and PMs, so that formen could buy into it and they would be able to make their decisions contractually or money wise with their PM sitting there. They would have their okay. So, we didn't want the foremen to say "well, I'd like to say I can do that, but I can't because my PM"... So, we put them all there. We did that the first three times until the foremen got used to say "Okay, I know my boundaries. I know what I can say yes to" and then now we don't waste the PMs time, tie up their time. So we did that, we pulled it back and in doing that we had each foremen say "it's gonna take ten days to pull off". A concrete superintendent cold say "I can pour it in one day". And then the next guy would say, it will take me three days to get the steel up – so, as we marked down our time duration, each individual function, each individual thing we ended up having all the time to do it. I don't remember the exact time, without even telling them which time I had – we hit it within the week. With just the foremen buying into it what they could do. And then from there, we started out with our board and we started a six-week-look-ahead type of thing. What we started at the beginning and how we gonna hit that point. This particular pull session wasn't completed on time and that has nothing to do the pull plan session. My steel wasn't released, it still hasn't been released. So, that's my thing to deal with – no problem. But, so that we didn't waste what we had – we are stilld riving to the same point. Even we don't have steel, we still the electrical cut, the demo, and everything for it... still the same task. It didn't go away. So, in my day-to-day*

operation and in my week-to-week foremen meeting... Tuesday we have a regular foremen meeting that we would have with or without plan. When everyone gets together and see where we are at. Here's my safety concerns, here is the delivery board, you know –all concerns or whatever. At the end of that we do the Pull Planning, we got to the parking lot board and we see what constraints and start doing out pull. My pull plan is almost more thing to a six week almost, but with the exact same intent and the exact same result. Even though we may have lost sight of that crib goal at the end. We haven't lost sight of the process and I kind of explained to the guys after I saw what Conny were going with this, when I saw how it was working, the first couple of weeks everybody stand back – it's gonna take me six weeks to do that... and then it took them three. It only took him three cause the guy before him knew what to get done, and the guy after keep an eye on him so as soon as he is done – I get in there. One of the great things with Pull Planning is when you're in front of a superintendents standpoint, when the subs are on sight – these are all experienced en, they all know how to ru this, so they already know where they gonna make their money on the job. Either typically floor work, quick and easy and they will make most their money there or maybe it's in the amenity spaces everything they do is high dollar money. That's immediately where they wanna take, no matter what where I want them to go. They want to go where the money is. With Pull Planning I force to get on the train. You get on the train and you get off the train, there is no in between. So, it kind of help the guys. They realize, once they realize how we were doing it, they realize “ okay, this is the way it goes”. So, now I have momentum. So every week, as I was watching the guys, quit sand bagging – then our percentage rate started to get better. They were in the 85-95%. That's where I wanted them anyway. If you're at 100% everyone is sand bagging, it's not doing anyone any good. If you're at 50% you are way too aggressive. So, I like to stay at that 85-ish. Me t are digging into the dirt but they are not quiet getting there, so there is where my momentum need to be. So, they have even asked me “Why are we doing this?” Well, it's like defragmenting the computer. You have all this information and all this space on this schedule. But there is a lot of empty spaces in the middle and if everybody is thinking about it – we can pull all that back and now we have all this disk space to use. Once you start thinking about it, common terms. They are like “ okay”. Now, instead of me them being on site waiting for two weeks for the plumber to get done with that – the plumber already knows he's ready to jump on it and then he know what stuff he needs to get there. He can get in, he can get in and they realize that they earn more money... because of the flow of not waiting. Usually, three men are waiting there, you're dying. I'm watching your profit go out the window. The success to my life is that I always make the subs money, cause if they are making money – I am making money. So, my idea is never to how I make money – I figure out how to make them omoney. SO, as son as I know how to make them money, I'll make money. Construction in a nut shell right there, how to make money anyway. If they don't make money they are dragging the whole boat, like an anchor. So this Pull Planning helps to keep everyone right there.

[For how long have you been doing Pull Planning?] Since March, a couple of months. I'm brand new... some green behind the ears.

Appendix E

Interview with interviewee E, a 57 year old General Foreman who implemented Lean about 5 years ago.

PART 2: PAST IMPLEMENTED SYSTEMS

- 1 Has your current company previously tried to implement other continuous improvement systems than Lean?

Yes No Don't know

[0:00] [...I'm very interested in Lean, do you know what Lean is?] *You know, I do... sort of, kind of... I mean, I'm working with it... like a lot of us are... when I got the call – I'm being honest with you, I talked to some of my peers in the trades and "what's Lean?" you know. Really, nobody knows, they really didn't know and these guys have been doing it for a long time and are successful. They are running big jobs and we're always using it, not knowing what it is...*

- 2 If yes,

- 2.1 What system was implemented?

[3:30] [You've worked for WVU since 84.] *Yes. [Did WVU try to implement something before, any kind of continuous improvement system, or initiative?] I guess... they were always doing something. We always try to, you asked me to be specific, but you know our coil line, plasma cutters – as far as that type of new technology they were always sort of going for. But as far as just... I'm a field guy you know... My thing was to get the job, get a project manager, get a roll of prints and I would go on the site and mainly field measure the job compare to how it is today - They're trying to do everything in a model, a BIM models. We call them downloads and they have everything, fabricated off of a shop drawing I guess. Back in the day, we were just measuring by the individual – we had a massive amount of prints and go out and figure it all out. Maybe, we got a diagram of: they want this size ductwork and it's gonna go from point A to point B. You would do all of the routing, a lot of it... sizing a lot of times. They wanted to get from point A to point B, they weren't 100% sure how they wanted to get there. So, that was a lot of us out at the field and we still do that, but then all this... It doesn't work everywhere. There are struggling with it here to some degree – being an old structure... You could see it at the meeting, we're on RFI 666 and it has all been modeled. I was just talking to a guy – where would we have been if it wasn't modeled, would we be at RFI 1600? No, no... It's a very tough job right now.*

- 2.2 What was successful and what was not? *Blank.*

- 3 Did you hear about Lean before your company mentioned that they would implement it?

Yes No

- 4 If yes,

- 4.1 What was your perception of Lean at the time?

[9:18] [So, did you hear about Lean or Pull Planning before you were introduced to it at WVU? Was this the first time you worked on a Lean job?] *I've heard Lean*

Construction for several years now and what I thought it was, was just the modeling and the assembling, prefabricating stuff in the shop... Also, I've seen it, I wasn't really involved with it, but I've seen it and I knew other trades were coming into our shop to coordinate and to plan. So, I imagine that is part of it too... Would that be Lean? [So, really collaboration?] Yes, right. You know we had buildings and I know on some of the projects we were getting the general contractor and everybody was coming in and was like "get everybody in the same room" – so that's my perception of Lean, which makes ton of sense too. Everybody needs to be onboard with this stuff to make it...

PART 3: INITIAL REACTION

- 5 When you were first introduced to Lean at your company, would you say that you immediately supported Lean efforts or were you somewhat skeptical?

[10:52] [How was it introduced to you? Was it ever introduced to you?] *No, it really never was [So, it was through culture?] Yes, exactly. [You didn't have the option to be skeptical or to even consider it?] Well, I read the email that they sent to you and they said I was sort of a "none believer"... and, I'm not 100% where they got that from – but, I like to think of myself as open minded and to change to better things, to be more competitive and have the edge over other... [and I'm not exactly sure that they picked you as a none believer...] well, they said it. They said it in the email that they sent to me, from Andy. [Andy said you were a none-believer?] I was, at one time – yes, but I don't know where they got it all from.*

[It sounds like this is the really first job you've been on?] *I mean, I've been on other projects, a handful, where we used our modeling... I've never Pull Planned before, so this is the first here... With our modeling, we call them downloads. We got our blue prints, all the pieces are numbered, and it's all cut out... in the shop and assembled... to certain sections or runs. For instance I can order... back, I'm gonna drive this kid crazy, back in the day we had these five foot long joints of this ductwork and we'd get it and we'd put it together out in the field, make our connections – we cut our "T":s in. We used our knowledge in where they ended up belonging, where we had to connect to. When we were lucky, we had a shop drawing they sort of showed. Now, I can order that piece there, all put together sealed and the "T" is cut in the precise spot. It's assembled. Was I a little skeptical to that? Yes, so maybe that's where... cause it's still doesn't really work everywhere. There are constraints, like here I haven't really ordered assembles – we still sort of putting it together here. What stops us from doing that? Getting it in the building. We have to either walk things up or bring it through a window that is 22 inches wide and then storage, it is such a tight space. A lot of my work that I have done I've done in my career here was in the loop, downtown, and it was just like there's nowhere. There's tiny elevators... When we started... they wanted us to use it, we want you to have 50 foot sections with all these "T":s cut in. I couldn't do it you know? So, you can't use it everywhere. But I get it, it is a wonderful thing. In our shop where our control environment there – it's well lit, floor space, we have unlimited supplies. Everything is there for you, you have people putting all this stuff together. They have saw horses, there's a lot of plusses. You can assemble these things you know? Unlike here, you've walked around here. You might not have seen the worst yet, it gets really terrible on the west side here. There's just nowhere to put... there's hardly anywhere to work on the site. It does work and the assemblies they were doing. I think it's really wonderful for the pipe fitters. I mean, I've been to shop and put together, making assemblies and it's either me and their... in a nicer environment, thing that are a little better, a little faster. But the pipe fitters with all their stuff, it's so much heavier, all that. They have cranes; they have all this equipment that they wouldn't be able to use out here. It would have been manpower... welding it by hand compare to a machine in the shop rotating it. I think it really did wonders for them*

6 Who or what influenced your attitude towards Lean?

[20:42] [Do you feel like someone influenced you to be okay with the “two week look ahead”?] *It would be our Superintendent assistant, I can imagine principle people send it down through our chain of command to our direct supervisor, to our field superintendent, they give the books and here you go...*

6.1 In what way did these people or events influence you?

[21:10] [So, you have a field superintendent?] *Yes, [and he is responsible for teaching people the look ahead?] Yes, we'd occasionally have a... they would pull a foreman into the shop. We have a little meeting on some things, but as far as Lean went – I don't remember it. I mean, I looked it up online to be honest with you. [How long ago?] How long ago did I look it up? After I got your call [So, it's pretty recently.] Yeah. I went today too.*

7 What arguments were you weighing against and for Lean?

[6:38] [Scheduling wise, has that changed? Are you using last planner or weekly work plans, like at today's meeting?]

Did that change? Well, one thing that they're doing... They're doing Pull Plans here which I think is a good idea – cause, they used to just tell us... the general contractor, they would formulate a schedule and tell you what you have to do and sequence everybody. They would do that, and they still do to some degree – sometimes, they don't really know. I guess, that's how all this came to be. Ask the guys that are doing it, or the company, our expertise - what it really takes to... “let's be realistic about it”. Cause so many times there were unrealistic schedules the old way. So, this is... it was the first for me, Pull Planning. [Here, at this job?] Yes, so... It makes sense and then of course I'm sure if I told them something they really couldn't work with, then they're gonna... If I say “it's gonna take six months to do this floor” then they... [So, this is the first job when you used Pull Planning?] Yes, I think it is an excellent idea – and we always sort of said it that the people in the field – they should be talking to us more. Not only work, but to us as a company. I know the duration it takes, but I like it. I think that's a really good idea.

[22:30] [You already mentioned pros and cons with the look-ahead-schedule, do you have anything more to say about that... I think that's the closest to Lean that you have implemented...] *I was always thinking in my mind, they just want us to think, they want us to think ahead at least and we all should. You shouldn't just react all the time. You should have a plan – even if it doesn't hold all the time.*

[29:41] *I think he was gonna use that two-week-look-ahead to try to figure out how many people you might need on a job... That information you know? Cause we submit that electronically and it goes to a two-week-look-ahead. We use a computer and then just send it off... Later they would use it even to sort of... cause I'll be telling them what I would be doing in these two weeks “I'm gonna have ten guys here and we're gonna be working on this floor”. I think they would use that as a tool, “also Chad is gonna need ten guys here for the next month or something” – whatever I wrote down. So, that's what bothered me some... It still does. I don't know how much they use it anymore, but if I was gonna say that I need ten guys for this job, and work in this area for the ext month. Our labor coordinator would sort of get a feel for how many men they would need, and for how long they need them... [How did it bother you?] That, I could see that I have all this work right here and... cause it changes and it was just... It seemed like nine out of ten times, what I thought would be I would be using ten guys for a month – I used ten guys for a week... “I can't use these guys anymore” and I had to call them up and say “hey, I can't use these ten guys for the month” There they are, “do something”... Cause things changes so much. So, I know that is what they are trying to do with it, part of it... partly trying to control the labor force and everything – get a better handle on it.*

- 8 What reaction would you say was common among your closest coworkers when Lean was implemented? [23:40]

Most of the people at my level at least... our opinions were, sometimes at some of the bigger projects it seems like that two-week-look-ahead might work a little better and on a newer project. Something that you can see, when you're not running into restraints and stuff like here "Oh, we've knocked this wall down and now we have asbestos". That was another issue [So, it works better with larger scale or new production, correct?] Right, it would be okay. But the people at my level, I would say mid-upper management... I'm not really sure, but it was a lot of remodeling and older worked and it seemed that we had more problems of this kind of stuff. It didn't seem to be, that was the consensus of the two-week-look-ahead – why am I gonna do this darn thing, cause the ink isn't even drying and it's already changed. That's the way it is a lot. [Renovation jobs are really hard.] Yeah, and they just change, but we do it and we do our best. It's a good thing, it gets you thinking. As long as they... you know, the way it's been from day one in the trades is that you have your Blake – WVU PM, superintendent and us... It was very Lean as well as levels on management, so then we've changed... I know when you get larger it takes more management, it just does. There's more of everything to control and to keep work. We started to get to CM so this CM, he sort of took care of all the trades, the sheet metal workers, pipers, the plumbers, and then they... It didn't work out that well, so we went back to the more specific supervisor like me – just for sheet metal that knows his end. They sort of switched to that and then they switched back. I believe that's better.

PART 4: ORGANIZATIONAL TRANSITION

- 9 How did your company announce that they would introduce Lean?

[18:00] [Were there any structural changes within WVU that took place? Did they introduce Lean or a weekly work plan where they wanted to change your ways of working? Was there some type of introduction to a new system?] *Not so much, not like a formal... They introduced "two week look ahead". [How long have you've done that?] How long had that been? It's been... maybe five year I would say. [But they never introduced that as part of Lean?] No, not what it exactly was. But, they were trying to make us think and plan ahead. That was always sort of tough cause things change so much. It's a nice thought that you can look ahead two weeks and to be accurate. I hated doing it on one hand cause things change daily in a construction site, I mean really – at the office sometimes, it all should work and it all should sort of be constructed. We got it all figured out, and sequence of people, but it just takes one trade... you heard it in the meeting... we have water filling up this hole, and your "two week look ahead" is out the window. There is just a lot of problems in the business. So, no it wasn't ever introduced to me as Lean, I'd say the "two week look ahead".*

[29:16] [They just started right away? (the two-week-look-ahead schedule)] *Yes, and they were gonna use that to I think as to...they had a labor coordinator in this group of managers like, he was going to – I think he was gonna use that two-week-look-ahead to try to figure out how many people you might need on a job...*

- 10 For how long was the decision to implement Lean discussed, planned and processed before an actual implementation?

[28:56] [So, you may not know this one – but, as for these two-weeks-look-ahead schedules. Do you know for how long they planned and processed the decision before they implemented it? The upper management... Did they talk about it?] *No*

- 11 What type of training did you get as the company decided to become Lean?

[33:03] [Did they ever train you the two-week-look-ahead in how to implement those tools that they gave you?] *The two-week-look-ahead was just briefly explained to me by my*

superintendent, you know, how to do it on my laptop you know “here’s what you do”. It’s pretty much self-explanatory.

11.1 How frequently did you receive Lean training or at what interval?

[33:33] [There’s no really continuous training going on?] *No. There isn’t. [Nothing they call Lean training?] No. Not with me at least at my level – some of the bigger projects, some of the higher up superintendents and foremen, general foremen, I mean they are involved in a lot more stuff in preconstruction. Preconstruction meetings and stuff. I really... we have kick off meetings and that didn’t seem to last... you sort of get everyone in the room together as a company: our draftsmen, our plumbers, plumbing foremen, pipe fitting, sheet metal, everybody just go over things. [That was job specific?] Yep, job specific. [We’re thinking more of a company being introduced to a specific concept...] Yeah, not with me.*

12 How would you have handled the transition to become Lean differently?

[35:06] [So, going back to the introduction of the two-week-look-ahead schedule, since it reminds me the most of Lean. Would you have handled that transition differently, the way they introduced it? Maybe in a corporate meeting? Or introduce it in a different fashion? Or maybe extend it to a six weeks schedule? Or is that too long?] *I think six weeks is way too much. They have a six weeks schedule here. They wanted one from us, RST, but it’s just – they can’t hardly do it themselves. It’s such a... it’s a nice thought. So, I think that they could train us a little better with this or introduce things a little better. I’m a sheet metal worker, I’m not terrific on the computer – but the younger guys had it from day one. You’ve always... so, we struggle a little bit through it as tradesmen. But, they give it to us and we do our best. I mean, give us that tool and teach us how to use it too.*

[It’s good to know that you’ve struggled too. The people we introduced so far has been general contractors and superintendents, so their perspectives are totally different. This is so good.] *I mean, I think WVU is a wonderful company. It really is. They treat their people well. They always have work, that’s a huge thing – to keep working steady. I think it’s the best place in the city as far as sheet metal work. I’ve been around for a little bit. I’ve been here for a long time. I have no complaints. What I am complaining, pointing out to you is just...*

[38:16] [It’s really an interesting perspective, my sense is that most of the Lean concepts are pushed a lot at the general contractor but it’s much more slowly making it’s way down to the specialty trade level. It’s gotta be a challenge.] *I was a little nervous with it cause I don’t know much about this stuff. I have told my superintendent... I always try to do what the company asks me to do. I don’t have a choice all the time – doesn’t matter. I’d like to be some help. I’m hardly an authority on Lean Construction I told my superintendent. “You know what? You’ve done enough of it the other way so maybe that will help”.*

PART 5: TRANSFORMATION

13 Can you describe the turning point when you understood the benefits of implementing Lean?

[39:34] [So, was there any point where the schedule actually worked, you somehow understood the benefits of it?] *Yeah, but I think what I said before. I think how they were using it before I didn’t see it working as far as being able to figure out the manpower. I think, this is just my thought, forcing us to try to think further down the line and plan. It would help ourselves, you know, to plan. So, I still haven’t seen it being accurate that two weeks. It’s still tough. It’s just changes so much. This is my level and that type of work we’re doing. In newer work I think maybe – you can see those two weeks ahead of you and actually be sort of accurate. It’s still not accurate when I’m here.*

- 14 How do you think friends, family, and co-workers see differences in your attitude and perspective of work after Lean was implemented?

[41:41] [Would you say that the schedule has given benefits as you can go home earlier, you have a better idea of what it looks like, more stress free. Do you think friends and family can see a difference? Has it impacted you in some way... that you can look ahead and not feel as overwhelmed...] *I don't see that it has a huge impact on me. We're always sort of thinking about work. Always. Form myself with the responsibility here to our workers, our journeymen, they'll get back to me and "what about this" and it's part of your life – work. I don't know, no huge impact. [It wasn't life changing?] No.*

- 15 How did work hours change? [43:05] *No.*

- 16 How did Lean change the way you communicate and collaborate at work?

[43:13] [Has it changed the way you communicate with your co-workers or other subcontractors? For this job, when RST is trying to implement a weekly work plan meeting, would you say that that technique we saw today has changed the way people are communicating? And collaborating too?] *Yeah, RST seems to... they wanna have a meeting everyday with us also. They wanna have a meeting at 1:30pm everyday with us. It's really something that we all do as different trades during the course of the day between ourselves. The only thing that is different is that... I mean, we all talk – sheet workers, plumbers, electrician, and so on. Everybody coordinates and talks throughout the job on daily basis. But, what RST is doing with... I think it's good. Their meetings, they have the agenda and everything – and that weekly look ahead, with tasks... it's good. But it doesn't work all the time still. It's always... [So, it hasn't really changed? You don't communicate more with your co-workers and subcontractors more because of this Pull Planning sessions or weekly meetings?] *Right. [It's still the same?] Yeah, I mean we've always had weekly meetings, with meeting minutes and schedules. I don't think it changed. This job is a little unique so they have a lot of issues. They worked on it a long time before we got here on site and they're still working on it, designing...**

- 17 What professional benefits have you seen within the organization by implementing Lean? *Blank.*

PART 6: IMPACT

- 18 Have you had someone mentoring you through this process of becoming Lean?

Yes No

- 19 What advice would you give to future Lean implementing workers in the same position that you were in?

[50:00] [So, a little more training and training on two-week schedule and on Lean, what's the goal with Lean?] *Right! Right! [More conceptual, because you're so much into the day-to-day?] Oh yeah, I really think that would be a wonderful thing. That's what we're doing to sort of just spell it out for everybody.*

[52:10] *I think a lot of it is just to do it. We always try to sort of plan and be not wasteful with materials. I think a lot of people, we were sort of doing it before it had a name maybe – to some degree. We just were successful – people that were running jobs. I think we did it to some degree... So, I have nothing else to say about it. Nothing I can pass along to someone. [More formal training?] More formal training in a nutshell.*

[47:34] [...any training?] *Not in detail. We have construction log books, daily stuff we are supposed to write down. Maybe it's me? They should give us people who can say "here's what you do with this stuff" As simple as that is, I know it's just a log [So, no one really trained you how to use the log?] Daily activities... yeah, but not really no and I know it's not really complicated. It's a log or a diary. But still, "here's something you really... really watch this..." [It's funny you bring it up cause when I think of a daily log I see it as a legal tool. So, really – they should tell you exactly what to put and not to put in there.] And in some of our foremen's meetings, we have foremen's meetings once or twice a year and they go over several things of what's going on or whatever in the company. They would say, we had a lot of problems on this job here – but thanks to Devon, who's really good with his daily log we were able to... we had some type of documentation that we could go back to and get compensated.*

Appendix F

Interview with interviewee F, a 49 year old Superintendent who implemented Lean about 14 years ago.

PART 2: PAST IMPLEMENTED SYSTEMS

- 1 Has your current company previously tried to implement other continuous improvement systems than Lean? [10:00]

Yes No Don't know

[3:02] [So, are you familiar with Lean?] *Yeah, I'm the prototype sup there back in 99. When Aston was first getting into it and Anna was our Project Manager. That was one of our fist Lean jobs that we essentially gave it a run. Probably a five-seven million dollar job and it was still... we had three phases that summarizes how we do it: we adjust it to the job as far as the Lean protocol – the percent complete. We change it up for every job we go to, but you know, pretty familiar. We've gone done Amsterdam and run some jobs and instituted that. I know Aston well, so I'm familiar with it. [We have to take you way back in your memory...] yeah, I've done Lean for almost 14... Well, that is one thing – you know NOP, they train their superintendents. A lot of Superintendents, before Lean came along... we didn't call it Lean then, but we did 16 and 20 week look-aheads. So, you would come into his office, a whiteboard all across and by contractor, area, work areas was already done. So, when Lean came – he's like. He wasn't against it, but he was like "that's that, but in a different format" The same language. So, it was an easy change for me, that part, but I remember he talked about it with the jobs we do back in the late 80s, middle 80s. We did them without phones, without fax machines, without computers. One Project Manager covering probably 10 times more than they cover now. There is a quite a different business there...*

- 2 If yes,

- 2.1 What system was implemented? [10:00]

They mainly would use Primavera, the planner, essentially the scheduling. As far as, we'll take the main schedule and we take a lot of time we worked backwards. We'd take the job and essentially we worked backwards, paint ceiling, a lot of our work... My first work with NOP was a prison, they had an occupancy date, so we worked from the gates to the cells, installation, walk it backwards and do a reverse scheduling quite a bit and then kind of delineate your timeframe of when you needed to be done. Also, working to the buy out – which they reclassified like procurement – essentially the buy out of the contract's material and delivery dates and lead times. We'd always work on lead-time, transformers, doors, hardware... it took a little more time probably. 12-16 weeks for hardware and doors to get sorted out. Even just manufacturing deliveries. It's a quicker process of some of it. The switchgear and such, cause they don't hold the inventory anymore – that has actually increased in lead-time. Essentially we would work it backwards and I wouldn't have a transformer for 12 weeks and you'd work you way backwards from there. That was a pretty similar process with all the project managers. We would essentially do, whether it's an excel spreadsheet. Generally just done on paper and we'd create your weeks and boxes and through the electrician in there – we'd get in his milestones dates. You need to be piped and wired, "what's it gonna take?" It was a form of doing Lean, but and we still do that back check process even though we do Lean.

[Did you call it something else?] *They'd just call it scheduling... We did a much shorter look as far as, it was "what do I need for these two weeks" minus the big items. You knew if you needed the MC or the air-handling units. Air handling units seemed to be a long lead. You'd be pushing 20 weeks and a lot bigger areas and getting that order out and getting that shop drawing and knowing that that shop was creating the latest design on it. That seemed to be the process more for scheduling. We just called it scheduling.*

2.2 What was successful and what was not? [13:25]

Oh yes, it worked well. We talk, even about Lean, a lot of the stuff that some people need to see on paper – you do it in your head, it's like doing math: you see it, you'd walk out there. We talked about it the other day, I can walk out there and tell them what I'm gonna finish and it won't matter if I know all tasks in my head. You'd get a feel for how long it's gonna take for the job. Other than some upset by the motors, something you couldn't get, you generally the scheduling was pretty easy. I will say this, your subcontractor and trade partners – they had a larger pool or let's say a more concentrated pool of talent. Cause, you didn't have the near work explosion that we've had in the 90s – ended in 2000. So, you'd have that layers from 60 down to 20. So, you'd had a ton of knowledge and experience – these guys whether they know it or not, they do their schedules in their heads. They are always planning as they go “Now we're gonna place concrete on the deck – okay that ar so many days to tie the bar and so many days for the studs, this much time to place it”. As different, new concrete pumps, whether the crane sizes have changed, you kind of change your scheduling of that – yet, there is a ton of talent. It's more water down, because flat out – people in the 60s college wasn't pushed “you gotta go to school, gotta go to school”. We talk about that all the time. There are a lot of missed out opportunities, it's just like – with any job, whatever your degree would be – but within civil engineering, there are 1000 some jobs... that's the same with carpentry. So, you know, we lost some of that talent. Where the people, their dad was a carpenter and the dad before them and they knew the business well. We lost some of that, there is a gap there where a lot of these kids they don't even know – whether they're union or not – they're not fluent about what opportunities whether it's owning your own business that are available to them. That's what's changed that I see as far as scheduling and planning. People there, they are mechanically inclined that see how stuff got built. They put their hands on stuff; they fixed their own bikes when they were little, now you're flat out without that you know? We talked about it, we didn't get a color TV until 1973. stuff like that; it's just a different time. I think, for the trades – you know those plumbers – you had so many levels of competence. That has changed, I started running jobs when I was 28 where ten years before that if I had been coming to the trades I wouldn't have been running jobs until I was probably 40. Just because, that there was that much talent. It wasn't that there was a hierarchy picking order, it's just... there was good talent. You're not gonna move in front of a guy who is just as talented as you that has 10 more years of experience. That's part of what I've seen change. What's changed also is that certain people wanna take, literally, for an extra 4000 dollar a year how much responsibility they want to take on... Even we're union and they essentially know what my pay is, everyone has a vision that I you have a company truck – you're 100 000 dollars over them. You're truly not, but... That's part of it. The middle aged guys, 25-35... some of them, their family life is getting busier. The wife's working, they weigh out that if I take the foreman's job I can't take the kids which means... where does the curve hit, where does it cross for them? And they made a cognitive choice, I can work as a journeyman – I don't need to move up the line and I'd be just as happy. I'll do the other stuff that I want to do. [Maybe happier?] Maybe happier. We'd get that a lot from the younger generation coming “What's in it for me?” ...

3 Did you hear about Lean before your company mentioned that they would implement it? [21:26]

Yes No

4 If yes,

4.1 What was your perception of Lean at the time? *Blank.*

PART 3: INITIAL REACTION

5 When you were first introduced to Lean at your company, would you say that you immediately supported Lean efforts or were you somewhat skeptical? [24:58]

We're always skeptical [Do you remember when you were introduced?] Yes. It would have been in 99, it would probably have been August/September of 99. I came off a college job and we were doing... Anna was the Project Manager. [So, you didn't immediately support Lean?] No, she was like "we're gonna do this and this is..." Anna was the Project Manager and she is a good Project Manager. She was the type of personality that "we're gonna give this a run and see where it takes us, but if it doesn't work we'll go to something else. But if it works, let's try it." A super person. She was the one, she's like "okay, let's get it up there" and Marty was the main superintendent. We essentially took it when... we had a little different phasing; we had a daily checklist of yes/no – 100% complete. It also, when we first did it, we had a triple redundancy. It took, probably the first time... it took probably three hours to schedule a small job. It's like, by the time you hit the third part of it you're beating us to death there. Anna was smart "okay, let's see what works and what doesn't" and even that first initial with Lean – that job was probably a half a year, nine months job. What we did initially, after the third session – this part is just too redundant, we already talked about that. So, even though she kept it up – we didn't actually... we wouldn't go through the format. She would go through the format just to keep the pace – trying to keep the flow. But, initially we didn't buy the whole program, because it should have been able to tie into our Primavera – so when we updated it in real time it should update it right away. We did not do that initially, so she had to manually adjust and she did it.

6 Who or what influenced your attitude towards Lean?

[41:37] *[So, would you say they influenced you to the negative?] Sometimes to the negative, sometimes just denying that... we generally are... we're trying to help you get done. So, you'll spend energy just training them saying "understand if we release it to the drywall, your work is behind him. You got the work in front of him and you got work behind him. You got to finish like anything else behind him..." [So, who did influence you – both positive and negative towards Lean and in what way?] Anna had the right attitude, I would say initially yes. But, another is Britney whose runs our office in Denver. She's from Eastern's office.*

6.1 In what way did these people or events influence you? **[42:35]**

She's just a good facilitator. It takes someone who can move it. She does a great job and she was the office manager and she knows how to get to the question "why didn't you get there without essentially pissing 'em off". Because, if you say "why", no one wants to be the guy with the "no". I laugh, I've got to the point where – it's like any schedule; you can sandbag a schedule if you want so you never have to say no. Or, I don't care – I'll go as aggressive as I can and if I take a no, even now when we did it in Fremont. It was probably 2001 or 04, Britney did a lot of facilitation on the planners. She's been with NOP since 83 – 30 years, but she's super good. No matter what she's doing, she was a great facilitator. She was the one that "okay, this is the why and how". Initially when you do the percent complete and you take a no, you'll have a reason. Well, if you're sitting there with a bunch of contract, trades people – and you say, I ask you "Cindy why didn't you get your electrical done" and you're looking... you essentially know the answer why, and they're like "you know why, cause he wasn't done" "Well, I was done..." You know? They go around. So, it's a little bit of that and a lot of people wanna be the guy that get his part done. So, when you say no and then you grill them why no – now you got someone who is OPQensive and you got another 25 items to hit with them... so, Britney was good at navigating that, which makes it easier to do it and then trying to get it done in an hour. The goal is always to get it done in an hour. As soon as they leave, you print out the planner. That's the weekly update we do, with the percent complete, the weekly update is essentially a six weeks – we have cooperated, we just did our planner there... Essentially, he's done a six week update right now and what we do now when we now the six week – we cover for the next week in the activity detail. What we'll do is write a note – if someone, lets say we're waiting for Caleb, one of the engineers who give a resolution to a design issue... so we put it on there, "Caleb did provide" and we'll write a little note in there. So in the activity detail we need to design questions/answers and as soon as it gets answered – I don't know what the answer is, it could be four weeks of re-piping... So, we changed it. Lean is a tool just as a hammer drill is, more than the job you're doing is the

people you have on the job. Cause you can run the system in it's proper entirety but if my plumber is like "means nothing to me, doesn't work". You need to morph it so it means something and becomes a useful tool. Every job we've done we've changed it up a little bit – reformatted it. A little bit how we apply it and then also it depends on how many self-perform work we're doing – so how much we're subbing. In Georgia they sub a lot and they will need it a lot more. Cause it's a lot of guys you don't know, never met. It depends, as we pick contractors, we've started to not only pick the contractors but the foremen. [That must make a big difference?] Well, it's huge and it's not that it's personally a friend – but they understand the common goal and they understand that I'm more than willing to help you to get to what you need and participate in the process.

7 What arguments were you weighing against and for Lean?

[37:00] [So, going back to your first initial reaction, when Anna introduced Lean... What were you thinking...? Was it Anna or Aston that did...?] *Anna with Aston... The first part was good, she did the main overview which is essentially is the six weeks. [So, she did some sort of training?] Probably with Aston. I'm not 100% sure, but she had the format and all that so she brought it up and we started to go through it and loading it up. Probably the second week is when we started working 100% complete. We did an initial load of jobs and really, that part loaded was pretty much like loading a shirt track in a shorter duration detail. [And that was Excel?] I believe so, it was all Excel.*

[48:57] [I'm gonna keep you in the past, when you implemented Lean. What arguments were you weighing for and against Lean at the time?] *Against, it was cumbersome at first. We didn't implement the whole system, so it didn't help us – it cost Anna a lot of time. It didn't help us a lot. The negative, none of the subcontractors had seen it so as we were learning it – we tried to teach them. They had no interest in it at all. That was detrimental starting that. Flat out, them not wanting to come along with you and understand that it's a pain in your butt, and it's gonna be a pain in everyone's butt for now. Dividends five years from now and ten hopefully make you a better planner for your own company. Take away what you want from it, whether your company uses it or not. Those have been the negatives; they're both huge negatives. You sit there and you're, flat out, you're keeping the guys from the field for three hours, two three hours.*

8 What reaction would you say was common among your closest coworkers when Lean was implemented?

[38:17] *Once you've gone through it three times, with a bunch of trade contractors – those guys probably had the most resistance to it – subcontractors. Because, they don't have near the buy-in like we do. We have to worry about everyone and they worry just about themselves. When you're a subcontractor you have a totally different mindset. You don't care so much about coordination as long as you can make money for your company on your end and you don't really care if you make the tenant successful as well as the electrician. Even though, inadvertently it might make you not successful. So, as a general contractor and construction manager – we need to make people successful otherwise we're not successful. That's the biggest thing, cause we had the subcontractor with us, getting them to spend their time. Now they're sitting there, first time scheduling meeting for three hours and it's a small job and he's like "I got a crew to run". That was the toughest stuff.*

[39:25] [So, you would say that the main thing that made you resist was actually because of the subcontractors who didn't buy into it?] *Oh yeah, there are two things: the redundancy, I mean when you get it right away and then you talk about it three more times... you're like "yeah, I understand. We just covered that. It's the same yes as the yes from before." The subcontractors, they are more resistance you know and we're like "we're not gonna get through this any faster unless you join in the parade and help us. You gotta give it a run before you can cry about it". That's generally as anything, it's getting beat up before you worry about what it's gonna do to you. Understand it before you complain about it and that is probably until this day... subcontractors they work for us, they work for VXY and we all run different and they know even before coming the amount of safety stuff we do. That continues to be, a lot of subcontractors we train them constantly. The ones we repeat a lot with, now we've got to the point when we pick the*

foreman. We do a lot more of that. It ties to what we're talking about but it ties to personalities too. They're use to it all, they understand how a system works. Even in 2010 I did a job, finished a job for another guy in Canton – and they'd never done Lean so to get them to understand, training them from what they normally done scheduling “well, I want to go across the street when VXY does this” “Why are you so much better?” That's the push back you get from them.

PART 4: ORGANIZATIONAL TRANSITION

- 9 How did your company announce that they would introduce Lean?

[21:30] [When did NOP introduce Lean?] *I would say somewhere around 98-99. We heard it from Aston, and he could give you, we had some classes and he came “okay, we're gonna try a new scheduling tool”. I think they used it in England for something and maybe on Heathrow airport... we wouldn't necessarily buy into the whole system. We were constantly sold systems that gonna improve your productivity. Aston was just really, he was the champion of it for NOP there “hey, I think this is something”. He'd been a good Project Manager and scheduler. [So, he was with the company and a Project Manager?] Correct, Aston's been with NOP probably 30 years, could be 28, could be as many as 32. Long time.*

[Do you know how he became so enthusiastic about Lean suddenly?]

[Interviewing colleague replies] I may know more than you. I think he hocked up with the founders of LCI – Gary Howard and Glenn Ballard. I'm imagining that he met them at some sort of conference. So, Gary and Glenn are the originators along with this other guy who is I believe from England. So they hocked up and I think a few companies called the pioneers, NOP, OPQ, there are a few others. They were right there with Gary and Glenn right from the beginning. That's probably how Aston got into it.] *Aston had done some jobs up in Bloomington that were very time constrained that even though it wasn't Lean – it was Lean. The planning had to be meticulous for them to hit the time window of good weather and then Aston did quite a bit of training for superintendents and Project Managers as one of his stands. He's always good guy, he's very down-to-earth and having run job also. So, when he saw Lean, he was like “this will work”. “We'll implement it and get the right people” you know? And it is, to get guys “hey, I've done it on a sheet of paper for 20 years and made money, so why do I have to switch?” Especially, when on some of their tasks it's very similar, we call it Lean, but it's scheduling and planning.*

[1:00:10] [Anna introduced Lean.] *Yeah. [Was the whole company assembled at once...? Or was it only for one job?] Only for a couple of jobs, select jobs. I don't know how they chose them. I think central operation down here... Finn, the group president, was willing to embrace it, on the industrial side they didn't do it at. [So they introduced Lean to a few jobs?] Exactly. [It wasn't like a big roll out?] No, and there are maybe people within the company that has still never done one.*

- 10 For how long was the decision to implement Lean discussed, planned and processed before an actual implementation? [1:01:22]

It was all up to Aston. He was in charge of training, so I would have guessed he could've don't it relatively soon and all he had to do was to get a couple of jobs to do it. I would think Aston was able to take it and say “alright, I've got Anna is willing to do it, this other PM – cause he knew Finn well and all that. “So, do you have any job that I could try to sign”. So, I imagine he was able to implement that portion pretty quick. I know for a fact that it was only a couple of jobs that did it.

- 11 What type of training did you get as the company decided to become Lean?

[33:33] [Did they make you read the Toyota way?] *They have read it, I resist at reading it. My thing with manufacturing. God bless them in manufacturing, but we do not end up doing the same. Every building we do is different and NOP we build a lot of hard buildings – they're very tight, very strain, always up against the resist... production systems for a lot of the stuff we do does not... not to mention the weather. I don't care where we are; it is such a huge part. When*

scheduling, you can schedule all you want... the trucking industry you know. We try to do with Lean and just in time deliveries. The trucking industry with the deregulations and everything and the amount of people that do essentially the contract trucking – it's a shotgun when a truck will come. Not to mention, the none-English speakers driving, Indian, Pakistani, it doesn't matter, Czechoslovakia – we got drivers from all over. And literally we'd ask how they would get there and sometimes you call them from two states and you're like "do you not have a GPS?" No, GPS in the truck and barely speak English and sometimes you get batches out of it from India. There's a lot of stuff. The theory is great, but these trucks sometimes flat out show up and they don't know what they are there to pick up, don't know who called them... so then you go through and try to figure out who'd order a truck, even with the terrorism deal there. We used to be able to call for a truck and they were able to just load it. You cannot ship anything without a bill labeling and if it has a possibility to be hazardous – you actually have to print a placket for the semi which is... and that is in the last five years. Nothing leaves without a bill or a label anymore. With the Toyota Way, we subsidize Japan to a certain point and France. The US government does. As we rebuilt their factories and all that – great, they are still subsidized with US money and you can do a heck of a lot of stuff there when you're getting subsidized. So, I'm not as impressed of what they do. If you think of what we do here in Wisconsin for manufacturing. This state puts out a ton of stuff, every state does. You look at Chicago, my gosh – the amount of talent out there. Yeah, I'm not impressed with them.

[1:02:11] *[Did the company provide you with training at this time?] No. They rolled it out, "here it is, sit down, see what you think". [But you've had training since? Uhuh. Just trial and error then and then having Anna and Aston...] well, Anna and Aston and we've been doing it consistently since – so the jobs I've been on since that point, that's 99. [But how did you know how to do it?] It's not that hard. [If they brought in a new superintendent, would they train him – or you'd learn by doing?] They'd show him, let's back up. They did, Britney did a little bit when we did Freemont's and the other new guys came and we'd already been doing it... We started, they would bring... with all the subcontractors, little schedule sessions of how it's supposed would work. So, she would do half hour training. I don't know how Britney got trained, other than she got enough snap I think showing her half an hour and she'd know exactly what she's supposed to do. It wasn't like... there's nothing magical to it, where it's hard to understand. It's a process we use anyhow and for me Gary was a Superintendent I worked with probably from late 94 until 98 and we were doing job after job. He essentially was doing Lean on a wake board, we had every contractor and he'd get them in there, all sit in there – it'd be the same planner we'd do it once a week and he'd say... we had a lot of suites, we had probably 30 suites different we're doing at a college... We had a big health science building, a couple of hundred thousand square feet. A suite might be a thousand square feet by four thousand square feet. Anyhow, he had every job role goal and all the different contractors on there and essentially week by week – so, we didn't necessarily have to hit the day and that was the thing with the old planner: you said you'd be done Wednesday, you're not done Wednesday – "well, why aren't you done Wednesday?" If it's a critical task cause the fire marshal's coming Thursday, then yes that's a big deal – but if it's "hey, I was gonna hang an extra 20 feet of ductwork and give you one more room" it's not the end of the world. That's the kind of stuff – some people have a hard time adjusting for that. There were guys that were doing the XYZ and he was like "you gonna pour these 30 columns" and for whatever reason rebar couldn't get those 30, so they'd take 20 and take ten over there – they still got 30 columns, but in his head it's a "no" but it's still kept the job moving. It didn't impact the final production, but that's... he doesn't work with us anymore because of that. But he could not, it was like the end of the world for him – he couldn't wrap his head around. "He sent me to get these tasks and the decking guy would be "if they did what they needed to get me going, I'm good" and he said like "but we said those other 30" It was funny to us, Harry was his name also "it doesn't matter, the decking guy is still coming behind you. We stayed in sequence, it's just not the sequence you had in your head. It changed because of stuff not being right, so you can't pour to just say you poured." So, maybe because of where I came from and that little company I worked for was so small and everyone knew what they were doing on the job with different durations, you didn't need it – you did it all the time. Like I said, when we did the bigger job with Gary – he had such a laid out schedule, that sometimes we went... we knew we needed to start setting steel December 15th, so we walked it backwards to start the foundation in August... We worked it back "alright, if I'm gonna walk up six stories, 140 feet – I need to hit these dates and we created essentially a Lean planner, we didn't call it a Lean planner. So, for me the morph to it, probably less than a lot of people.*

11.1 How frequently did you receive Lean training or at what interval? *Blank.*

12 How would you have handled the transition to become Lean differently? [1:07:06]

I don't know. It would have been, you know it's hard when you're just buying a program that no one has used there and say "grow it company wide" and hope for the best and change the way that everyone has been doing for a company that has been in the business for 100 years already, to roll it out company wide. I would roll it, if I were them, I'd roll it all the same way they did. They provided more than enough of know-how and how to do it. They had the right people facilitating it. I would say, as they move farther along, and they'd got into four-five years – the only thing I would have done different as a company if I would have been... I'd press upon them "hey, this will help you" but also, some people get into it that they can't change it – it's a tool. Some people... I laugh at it, my brother and I manage differently and much more of a macro manager than he is – but he has no problem morphing the system the way it is, there's some people who just can't... there are some Project Managers mainly that's just how they are built, they have a hard time adjusting that. No different than our financial management system, it's a tool, and we have people in there very brain oriented and they have a hard time morphing it cause jobs change and tax codes and all that. Sometimes you gotta manipulate to work for that job and we see them struggle with that. Other their unwillingness to step outside the perimeter and say "alright, it's not working for this job". Smaller jobs sometimes were Lean, sometimes they will use it – sometimes they won't. It's a four-week job, sometimes they'll use Lean, and sometimes they won't. Depends on how quick headed it is, you're talking to jobs sometimes – there are two guys there... he goes in there and it's three weeks of work you know – a 40,000 dollar job or 25,000 and it's not a lot of money. They won't use it. Essentially, it's all... they will and they won't – if they build a little six weeks quick schedule and it's done – they don't do a daily deal cause it's already done in there – everything's here... They're doing a good job out of that on some of these other jobs. They'll do a lot of pull planner, we don't always use Lean – we know pull scheduling. We've done pull schedule, because a lot of the times, even if you're doing Lean – what we do in our head, a lot of people have to see a pull planner to be able to put it and make it go into the regular six week planner... even the plumber, how many times has he seen painter around on site there. He laughs of the idea of a painter – he might have walked by a painter a 1000 times, they get very focused there. So, getting them to understand other tasks that will impact someone else – sometimes we'll do the pull scheduling or the Takt Time.

PART 5: TRANSFORMATION

13 Can you describe the turning point when you understood the benefits of implementing Lean?

[50:45] [How long did it take before you saw the benefits?] *Probably somewhere around 2002-2003. [That's a few years.] Oh yeah, you gotta realize even as a company only certain Project Managers took it on. So, you could go to another job and they were still just using primavera I believe at that time. So, you'd go to another NOP job and they didn't do it at all – so there wasn't a consistency at all what we were doing back then. That's, like I said, I went down to Amsterdam in 09 and I finished a job down there and they weren't using it at all. We'd had as a company by then 10 years. So, certain Project Managers that don't like it. So, it wasn't like we did it for three-four years straight. You'd go to another job and that Project Manager wasn't using it. As far as, you get new people and whether they've been in 10 years in the business or for 30 years – if they've never seen it and don't want to agree with it you may not use it. I doubt that you are as Lean as your planner for NOP. They, flat out, they leave some latitude there. Certain people embrace it and the benefit is huge but it's like any schedule – if you don't hit the dates and you don't and if it's not a truthful schedule, it'll lose, I don't care how good of a planning session that it is, they'll use all its legs. If they walk out and they're like "I can wipe that on my butt. It's worth nothing" because you don't hit any commitments – then it's junk to them. [Have you seen that?] Oh gosh, yeah. I'll give you this point... People would say "you can move those sticky pads all over, you're not hitting one of your dates – it's worthless to me" and that's what happens when you get to that when it's not useful and you're not hitting those dates anymore. That was early on they used to want footage when you did early back when we did Lean – "how many feet of pipe are you gonna install today?" I don't know if you remember that. Anyway, that was part of their deal. You'd be like "I'm gonna hang 35 sheets of dry wall in this area, so what the fitters would do is that they just did a 1000 feet of pipe and it'll be in a corridor or whatever. They wouldn't even care if they were working there. I remember, that's gonna be every week and that's when Don was*

really good “the goal is not to be working over each other and be productive in your space” That’s all part of planning or Lean initially, yes – the space is ready for you and the constraints. And they would be flat out “a 1000 feet, yeah” and when we went to the percent complete they’d be like “yep, got it” No one is out there measuring a 1000 feet and they’d be like and then they’d get out there and essentially coordinate in the field that you were supposed to be coordinating there just trying to make sure “are we hitting it?” and that’s what Diego, who’s out – he’s 30 years with NOP too, the V.P out in Denver now... He said “we cannot be 80% on percent complete and keep sliding weeks, one of the two is a lie” and he’s like “give us factuals cause otherwise it’s worthless” and that was in 2004. Like I said, when you got a guy like Niclas here – with the right personality for it, he gets his Project Managers that’s like you’re gonna find a tool that works well with this, but that’s Lean for us. It does a good job and he’s a good mentor for it. It’s like anything we do here, it comes down to people. With the best systems, with the best tools, but if you don’t have people – you will suffer, you will not get home. I said, I went down and I had troubles with a job down in Amsterdam – I actually went down and they sat me down and “my gosh Eddy – 10months?” But, the real story is the way I got out there was I brought 20 of my good guys. Because you don’t have to explain to them what you need done and then that being productivity, safety, it brings schedule, and it bring all of it. Because, now they see you will make your commitments. The job I went to in Canton, they let go of the Superintendent and it was a good job and they weren’t money hurting, but they just could not get out their own way and then number one OPQ was NOP was the last one... we were the last one finishing all the time, we couldn’t make our commitments and the drywallers are like “you’re the one holding the whole train up” and flat out I took out three good foremen, they had great trades people and it was just how they were organized and the one guy even said, I said “you didn’t even, you had the right people” he said “yeah, but a bad leader” and that’s essentially what it is – it wasn’t lack of talent, it was just lack of organization. But the Lean planner they were using was not working for the subs... they didn’t understand it and that’s what I said to them “if it doesn’t work in their heads – morph it.” It’s a great system, but it doesn’t have to be the same if I go to Denver and other areas” It will look very similar, but it doesn’t have to be identical to be effective, to be a planner, to be Lean scheduling planning. But just-in-time-deliveries, it’s a great thought. It happens for a good extent, but not even... you gotta realize the feds have put on what no one can hold inventory without being taxed on it. So, they’re all just making time. That’s the stuff that people don’t realize with manufacturing, they get taxed if they have inventory. So, they hold no inventory – so where are you supposed to use just-in-time when it means you ship it twice and warehouse it. They used to have it in the shelf, “you need a motor bearing?” It’s getting made. “You need a part form for the crane?” They have to make it. It’s not on the shelf – there are other stuff for just-in-time-delivery that is driven by stuff outside, well outside construction.

[1:10:40] [In 2003-2004 you saw the benefits of Lean... at that point you’ve been consistently using Lean?] Four, five years. What was changing was flux of people, different Project Managers... The jobs got bigger, so you’d add a Project Manager and you’d have someone like Anna who is consistent there and say that another Project Manager came on site... the job with Anna was 5-7 million and the tower job was 175 million. So, there was also an influence of coordinators/secretaries. They do more than that, you add them to who have not done it... and then you’re adding Diego, the V.P, came out of our Harrisburg office when we had one down there. He came, he was not doing it at that time... you know, so – he’s gotta learn it. So, as they all get on and it’s a learning experience. You had a group of... increased to 6-7 Project Managers and a couple of VPs, mechanical guy, engineer and two-three superintendents and all your trade partners. That’s when you start to see, okay, and flat out the rebar guy could not – he’s just an eight man crew, eight to ten man crew, but he could keep up with 50 guys, so to take his time – a lot of times is what we did morphing it – I’d take his information and would essentially talk for him. There are certain guys I gotta waterproof with three guys, I can talk for him and can schedule for him and I’m not trying to get him into... need to do this. The morph was also to get the Project Manager out of there, and the foreman in. Cause he is making commitments that the foreman doesn’t know about. He’d go out on site... that’s when we started to “okay, you get out of here and bring the guy that really matters. I don’t need to waste your time, but I’m gonna need your foreman – cause you’re making commitments for him and you could be in here with him, so you know what commitments he’s buying you to. But, you’re talking for him saying yes he can be done plumbing in 12 rooms when the plumber say you know, the shop hasn’t even built the prefab”

[1:13:35] [So, you got onboard when you saw that people around you were onboard?] Yeah [And that’s when the benefits showed?] The benefits were when they got all on board and they started to

all understand and we also, we learned too differentiating what people we needed in there to be successful when we plan... the Project Manager of plumbing would come and not his foreman and he's like "yeah, he'll be done" and you go out and you say "hey Ivan, James said you're gonna have that done" and you know he looks and "it's not even here" and I'm like "I realize that, that's why I'm telling you what Ivan is committing you to so unless you have a surprise delivery coming..." which would than also change the Lean planner cause we cover the deliveries... what we did also with the Lean planner, we covered crane usage and deliveries. So, we knew who was using the crane when and we started to use it as a scheduling tool for when the crane... we had three tower cranes, what tower crane would be in use – because if I'm placing concrete with that tower crane, it's essentially gonna be for three hours. There's no reason for him to have a truck coming, getting delivery, and that kind of... it tied into that.... That's what changed that, that's why we brought so many more people into the fold you know. Essentially we changed it more, morphed it, utilized it, and we understood "you get better in how you're ask questions". People are touchy, and we're not always great asker of questions on how we present it.

[1:15:30] *[Was there one project where you got an "aha"-moment?] That would have been Fremont's tower project. That was the one where "okay" and that's probably a year into it maybe – a year and a half. It wasn't really as much "aha" to me as to... you watch the subcontractors understand it. It's a helpful tool to them and that they could use it – it was a cardiac tower. It's one of a kind and that's why when you look at it – it starts at 80 feet high... it's built on top of a parking ramp. It takes a ton of coordination, but you're talking to a ton of talent... They were all top of the line guys for us and assemble that team was successful. You can plan all you want, but unless you have talent – you'll fall flat on your face. That's just how it is.*

- 14 How do you think friends, family, and co-workers see differences in your attitude and perspective of work after Lean was implemented?

[1:17:08] *[Do you think friends, family, co-workers, or any of the surrounding people saw a difference of how you perceived work after Lean was implemented? Decreased stress level, you enjoyed work more or less?] I don't think so. No. Not personally, like I said, my wife's a nurse and math to her doesn't come easy – math to me, I do it in my head... that's just a difference. You're either built for it, or you're not – you can get better at it, but there's people I watch, you can look at that vault and I can tell you how it's built. I can see it in my head there, that's the same with numbers and people are adding up and you ask, how did you get there and it's just there. That's why I say even with Lean people like nagging on how much training that we need, you don't need a lot of training if you got people that understand how it's get built and how you've essentially built your schedule in your head.*

- 15 How did work hours change? **[1:18:36]**

No... We work you know, hospital work flat out is a different animal. Schools, hospitals, powerhouses are different – they have a lot o money and the sooner they're open, the sooner they're making money. The money they pay us is a small bit on what's working over time. So, if they spend an extra million pushing us out on construction work to get that hospital open, they'll make that back in a month anyhow. So, working wise – it didn't change that much... We work with a ton of talent, so it's easy to work here.

- 16 How did Lean change the way you communicate and collaborate at work?

[1:21:20] *[Did Lean change how co-workers, your subcontractors, and you communicate and collaborate?] It got the subs thinking more about their workload and how it affects the other subcontractors or their partners. It got the sub to think farther terms than just three weeks in advance. It's still, depending on the guy, some will engage it, some will "I have my problem here, right in front of me – I don't care about four weeks down the line". Whereas, if you worry about those four weeks down the line – the problem in front f you will go away next time you come to it. It's just a communication tool. Lean does a lot of stuff, but it's a communication tool and if you get it out to them... our other problem with Lean... not a problem, but it's a result of... we do the Lean*

Planner and all that and what I'll do is print them – because the foremen out there in the field, subcontractors, they don't have a computer here. So, we put it on a computer – how are they gonna see it? So, we still paper copy it to them. Sometimes you'll be like this sup "have you seen this?" they'll be "no", so as bosses participating we'll print out the Lean planner and I'll put it on the lunchroom tables. They can do whatever they want with it, but at least they have the information. Some will read it, some won't – it doesn't matter, it's available to them. They all know stuff, why you might not be able to do according to plan, you're just missing something – so if you get the information out there... the more information that is passed out there the easier the job is gonna be. You may be like "ey, pour concrete" and someone is like "don't forget that the excavator is digging there". That's where the pump is set up and it doesn't necessarily affect the deck pour, but it'll affect the set up to the deck pour. It's still a problem to get them all out there. Flat out, an electrician foreman who's been here for two years didn't know we had an office up here... So, stuff you take for granted. [So, would you say that it's more team oriented now, thanks to Lean?] Depends on the job, depends on the people. It can be with it, it will become a better team if you've got good people.

17 What professional benefits have you seen within the organization by implementing Lean?

[1:24:28] *[Do you see more satisfied clients?] Oh my gosh, that one is just taking off for us. That one is exploding for us. That one is really kicking ass. I kind of also driven by KLM out in California, when KLM jumped on with Lean four years ago maybe – when they went full boat in, they turned a lot of heads "KLM is doing it, we should be doing it" and we were already in it and KLM took us, cause we're o heavy on Lean, on one level training them in Lean. Then, we got an architectural firm, a couple of them out of Chicago that also doing Lean internally, which is new... That one, company wide, the opportunities for CM negotiating exploded on calls. You're starting to see a lot of customers that would not be a part of a manufacturing segment, but understanding "hey, even if I'm a hospital there's a benefit to streamline my operations so I can plan better". Lower costs, better clients, patients – so that part, that one is new. Like I said, that job in Indiana got us on the KLM job... it's all because what we did on KLM. They say "take NOP, take NOP". The game is on. Aston is out there, so we got our main guy. KLM is a 700 million to a billion dollar project, ready to kick off, it has been four years of planning. After 2520 days, we're actually ready to break ground. NOP is successful there for a lot of reasons. Aston and his leadership, but there's also – you take 5-6 main people go out there with 20+ more for the company. They understand that a lot of the resources that the company has and how to schedule – Primavera, Lean... It doesn't matter what the system it is and they know how to work as a team. That gets them home, that's what makes them successful there. Work is starting to take on...*

PART 6: IMPACT

18 Have you had someone mentoring you through this process of becoming Lean? **[1:30:08]**

Yes No

[Did you mentor someone else?] I've got young guys, you know, foremen we want to bring up – a step into Lean and that... they're gonna be superintendents you know and I tell them selflessly that I want them to do a good job so they keep paying into my pension and social security. I'm more of a self-serving for that, but if we're all in the same system it's easier to go from job to job and the goal is always that I die tomorrow, they've been trained well enough to come in and walk right in the system and they're used to it and they run it. I think having conformity of one thing. It's not necessarily branding yourself, but having conformity that no matter what job you go to you should be able to pull up the schedule and be somewhat the same. You'll have that same:ness. And when I went up to Canton, they did, they were doing the exact same thing and Klaus was the Project Manager up there. Klaus was already doing the exact, so it wasn't like I had to transition to how you're scheduling and that's what makes it. When I went to Amsterdam, they had no scheduling. But, they had a Project Manager that had never done Lean, so we essentially brought down a Project Manager and we implemented it and then... And they said "for two years we guys haven't hit a shit for date, now all of a sudden you got this new plan and we're gonna hit the date?" I said

“Have you ever worked with me?” the answer is “no” so I said “So, I’ve not failed you yet to this point, right?” he said “no” “then we gotta move on from here and until I fail you, you gotta have to go with me and give it a run” and that generally works. When I fail you, you’ll have a reason to bitch about it. [Is the mentoring scheduled?] No. We start bringing them in to the planner and whether they’re involved or not they’ll sit at the table and they’ll see. Cause, part of the problem by doing the planner in Lean – you have to publically speak. Most people are first, I don’t care if it’s me or whoever – those first times, you’re now trying to go through the planner but you’re standing up the board and there is 35 people... and they are all looking at you and you’re supposed to be facilitating as a superintendent.

- 19 What advice would you give to future Lean implementing workers in the same position that you were in?

[1:34:36] *[I forgot to ask you something before, subcontractors –when they didn’t buy into it... that was the biggest struggle in the beginning – what is your secret to get them on board?] Probably use levity more, I think also, you know a lot of the contractors – the more they know you, your reputation is out there, they know about you when you come there... that buys you a certain amount of legs there. If you go in an area where you’re cold, you essentially gotta get out there and my biggest one is we’ve done a better job making sure their names are on there and even if it’s a foreman I can go “hey Lee, this is what I need you to do”. There is a reason why should know their name. There is a whole trust communication thing going on there that, I said “my goal is that I know every guys name without looking at their hard hat” – whether you can remember them all, that’s a whole different thing when you got 300. But if you know 90% of them, that will get you where you need to be – no matter if you’re trying to schedule them or safety, whatever it is... My other thing is that you start getting to know these guys personally – “hey, you like to hunt. Dude, you wanna fall off the ladder? I mean good guy, hunt season you know – you won’t be able to pull your bow...” It changes stuff and you change how you manage. We used to scream a lot. “You’re a hero compare to what you used to be”... we do personnel profiles for just even for how they load jobs sometimes. [So, they have everybody’s personality profile?] Of the superintendents and Project Managers, not the crew. But, that depends – sometimes they’ll try to match it, sometimes it’s just for fun. But, flat out – you know it when you do it. Most of our Project Manager fall somewhere in the type of a conformist, you might get someone that will push flat down on a dominant line, but almost everyone of our sups are for any reason on the dominant side there. Depending on the situation you’ll flex up and down. Generally, your PMs are somewhere over here and most of the crew is over here and you can’t just... that part has changed... No matter if you’re planning or what you’re doing. Everyone in that room has something going on, “you’re in school” next guy’s mama might be dying, another guy is a gambler with dept up to his ass, might be an alcoholic, this guy might have a whole volleyball team he’s gotta schedule – it doesn’t matter. Everybody’s got something going on. The more you do this, the more cognitive you need to be... you gotta realize they all got other stuff going on that is not necessarily on your agenda... Understand who you’re talking to and what the environment is and there are days when you’ll have great planning sessions and other when “good God, that was a waste of time”. And I don’t care what schedule you do, whether it’s a pull planner, sometimes there just don’t want to go with you. And you don’t give up “okay, let me find another route”. You got a ton of A personalities in there that don’t want to – their way is the right way and that’s just the way it is.*

19.1 EXTRA QUESTIONS

[18:52] *[Would you say it’s less career focused today?] In a way yes, it’s a pick-and-chose. It’s a responsibility level, stress level. Some of the guys they flat out don’t handle stress well. Sometime they take the job when they’re like “wow, way more than I wanted. Way more than I thought it was”. They’re great technician in the field, but they cannot necessarily translate that to making someone else a great technician, where they can’t stand to see someone who knows less than a technician struggling when they are like moving all this and do it. There’s some of that too, you get a little bit more aware... But I’ve been lucky; I’ve been with a ton of great Project Managers and superintendents. That part again, sometimes you just hit it. For me, it’s worked well – I’ve worked with a lot of talented guys.*

[27:38] [So, you used excel and you wanted to upload to Primavera?] *It was suppose to tie in so that when we did the upload and all the changes you made in there would adjust you primavera scheduling. There's some Anna had to do to make it work. Aston came down and walked this through and he helped us out on how to do the day... what we got to is, going through it daily was too much. They used to have a daily yes/no, and they said they used it at Heathrow... [And yes/no was for activities?] Yes. Essentially, then you had a weekly percentage complete. It was pretty intense. It was like, "wow". Anna was by herself and we didn't have... we had a fax machine on the job site, we didn't have a computer yet on the job site. We'd just got cell phones and we had mainly pagers before that – Motorolas, we still run with Motorola Radios... Communication is key as anything, and communication with any crew is super key...*

[30:48] [You talked about the daily... I think the contractors are doing daily except that they walk the site in the morning to see "did they get it done what was suppose to be done yesterday?" and check it off – that their yes/no. Do you guys do that?] *Some jobs do that, some NOP jobs. I do not. [A weekly check?] More so what we'll do is that we have a meeting every morning, not necessarily the planner there but the communication is heavy every morning we'd do it at 7:30. Sometimes we have such a large crew so one time we did staggered starts and that way all the subcontractors were here plus we're self-performing quite a bit of it. But we did staggered starts from six all the way to seven... We kind of use a scheduling trailer; it's more from a half size of this to a semi fitter out there. He's smart guy, used to work for QRS – Aston's his name. He's used to the ISO9000, The Toyota Way, Lean. So what he did – he implemented some stuff you won't even see in any other fitter job with it other than us – because he's taking what he did with manufacturing for QRS and warped it into regular construction... A lot of these guys have worked for UVX or QRS. They are familiar with it, Toyota – which somewhat runs parallel to Lean to some extent. Even though it's manufacturing.*

Appendix G

Interview with interviewee G, a 54 year old Superintendent who implemented Lean about 14 years ago.

PART 2: PAST IMPLEMENTED SYSTEMS

- 1 Has your current company previously tried to implement other continuous improvement systems than Lean? [6:13]

Yes X No Don't know

[4:56] [First of all, I guess you joined right before they implemented Lean?]

Keep in mind, when I first joined CBA I was not a foreman for them, you know, for several years, and then I was, and then I was somewhat privy to their processes, and then so, I'm going to do the best I can as far as pre-Lean/post Lean. I know that's really your focus. Most of my experience with the scheduling is with Lean, I do know a lot about that. And some new Lean techniques, like tact.

- 2 If yes,
2.1 What system was implemented? *Blank*
2.2 What was successful and what was not? *Blank*

- 3 Did you hear about Lean before your company mentioned that they would implement it? [7:05]

Yes X No Don't know

- 4 If yes,
4.1 What was your perception of Lean at the time? *Blank*

PART 3: INITIAL REACTION

- 5 When you were first introduced to Lean at your company, would you say that you immediately supported Lean efforts or were you somewhat skeptical? [7:35]

My first response was "Lean well of course who wouldn't want to"- well I thought Lean as in the normal generic thought process of being efficient, right? And that's part of it but not all of it. Well about being efficient "who the hell would not want to run their organization like that?" Of course their going to run it. I thought it was a fancy word for what we're doing anyway. You've probably heard that before. Probably a familiar refrain. I'm sure. Well you know, and I remember hearing "we're using this planner and this and that." Well, "how is it different than anything else? How is an improvement? What, does it track it more, you know, accurately?" Now I know some of those things. You know, better predictor, better production, outcome. Yeah, pretty skeptical. Definitely.

- 6 Who or what influenced your attitude towards Lean? [9:00]

The Superintendent I was working for and project managers... [and they were fully on board?]

They were fully on board. At that point, it was still somewhat new to them. But they, say, for instance, they had used it for a year and were a lot more familiar with it, then, of course and were like, hey this is what CBA, we're going to use this process moving forward. I didn't have a lot of push back in terms of concrete issues against it. [There was no time to question, I guess] That's

often the case. Now it's different. Back then it was like, "this is what CBA wants to use and you're going to use it and don't object to it." That's paraphrasing, of course.

6.1 In what way did these people or events influence you?

[10:10] [In what way did superintendent influence you? How did they push you and help you see its benefit? Was it a particular superintendent?]

Probably, one of the first I worked for was Alvin, I don't know if he's retired now. Barry probably too, maybe Igor mentioned that name more so. Alvin was a big one, really good superintendent.

[How did they bring you along?]

There wasn't a ton of sit down like you normally would like with some systems. Obviously, We had several meetings, just kinda like here's how this is. There wasn't a lot of going over in detail on how it is. Maybe its assemblies, maybe it was I'm going to print one of this for your benefit, here's what we're following on, and then eventually being in a meeting. That's how it usually is with anything anyway. You know, I mean, that's what I do with my foreman. I think were a lot better with that, we try to get them in the meetings. But the problem with that is I need them on the field. Right? It turns out there's a lot of benefit for them to be in there and its not just on written paper, its what they hear and how its conducted and all the rest. There's a lot of discussion that's not down on paper and documented. So uh yeah, it's more about here's a hard copy, you can take a look at it and you can follow the Last Planner.

Its funny you're asking about this, because its something we brought up in the superintendents meeting. Its often the way field leadership is developed is they see talent in somebody when they are physically doing the work, but much more importantly than doing the work is knowing what to do, knowing how to orchestrate it; leadership. All of those are really what matter. Whether I know how to put a door closure on door in 15 minutes or 10 minutes, you know, as opposed to my journeyman out in the field. What's really important is that I know I can walk in a room and "bam boom" look at everything. So what we talked about in these superintendent meetings is actually trying to get some of this paperwork and some of the processes and the thought processes is something that CBA's really big on is the culture, behavior, and all of that. You know Casey? [Yeah] So, Casey is like "Hey we could show you... yeah here's Takt Plan, we got this line, and here's this there's the choo choo train and blah blah blah..." all that but to get all that let's get your mind right first and then this will all come, but the thought process has to come first. So we've done a little bit of that with the superintendents but usually its more just in the field. Like I said, recognizing someone that's a going to be good as a leader and can run work and run people and communicate with them and then where the process fallen off I think we're improving then as we're moving them along, its like okay you run those guys over there as opposed to sitting down with those formal meetings and going through alright here's how we think and all of that and I think we need to do that a lot sooner with our foreman and then even because most of it, I know its an odd word to use, but it just happens naturally, but it could happen a lot more efficiently and quicker and in a better manner if it wasn't just allowed to happen, actually foster it more. Yeah so my upbringing was more "yeah I can see this guy's got it" and "alright you ready? Here take those guys and lead over there" right? as opposed to "here's how we do it" and we have so much paperwork and all of that that we're always trying to get control of and it gets unwieldy we don't have a lot of education for them for the foreman and superintendents.

7 What arguments were you weighing against and for Lean? **[16:08]**

See the other part of Lean with the last planner and some of these others and even with the last planner now, what I've always said is the superintendent's been the magic out in the field. What

does that mean? They're the ones, typical construction, they're orchestrating the sequence and they're orchestrating when someone's supposed to be where in the handoffs, okay? I mean the PM's got a rough idea and stuff like this but really when we're walking through its like "hey instead of them at the end of the day being done with that interior framing, oh they're done at noon." "Hey electricians you can go there at one o'clock go ahead, you know, and call them" or whatever and "hey are you available? Yeah we got some guys we can put on that." That's typically how it goes. And that's the magic made by the superintendent in the field. Well, that's good and bad. The problem with that is that one, it may not be repeatable, two, is that you've got a sole person that's the magic instead of the entire construction team. Right? So it's not my approach, its like we have to get everybody engaged so that the entire team can be the magic rather than just one person. [So would you say that Lean helps?] Absolutely. Get's everybody in the process.

[Could you see that already at this time? That Lean would be a good part in bringing people together?] Not, no, infancy not when it was back there I was just trying to continue learn my craft, and learn being a foreman and a superintendent. You know, that's the problem with everything you know when we talk about the fires is all is that all that you're so busy in the now that sometimes you can't be preparing for the future and then you recreate your fire don't you? Continuously bum bum bum bum, again, again, again, again. It's a viscous cycle.

- 8 What reaction would you say was common among your closest coworkers when Lean was implemented? [18:35]

There's a lot. You know, some negative but not a ton. A lot of the same concerns, you know, not bravado, but "hey you know, we make it happen on the field anyway. Yeah, we can have it on paper. We're gonna make it happen anyway. We're gonna do it anyway. We're gonna make it happen on the field." Its funny now we just schedule like crazy, which now I'm to a point where I could use a better intern but that's another thing. Overall we've had outstanding interns. Now I'm getting bogged down on scheduling. But, its better to have a schedule no matter what so I'm getting a little bit bogged down and really not our two big schedules our Last Planner and then our Takt Plan. We have to have both, we don't have just one or the other but parts of a building and what not are not conducive to either. Maybe a Last Planner would work for it. But we've got a lot of areas that require a little mini separate schedules so all of sudden you get twelve schedules like this which is good and bad. One is that you can clearly see, "hey we've got this, this is this elevator lobby area and here's the schedule here." But it takes time and somebody's got to do it. Takes meetings. Takes superintendents and subcontractors getting together so there's some kind of balance that needs to be achieved.

[20:10] [So would you say there's an over scheduling right now?]

Yeah, in the last couple weeks its kinda bothering me, yeah. Over schedule but I realize the benefit is huge so I'm a big proponent of it. But on the other hand its like I wish I had somebody that could do it.

PART 4: ORGANIZATIONAL TRANSITION

- 9 How did your company announce that they would introduce Lean? [20:40]

I don't remember that because it was pretty much already there. Even though I'm an old geezer and probably not the best recall. [When was there the awareness that they had adopted Lean? Because we got the impression it was somewhat gradual.] That's probably true... Yeah absolutely. Like most things, it's usually a gradual introduction. You know even those exposed part right there at the end of the 90s maybe a lot more so by '03 or so 10 years ago or so something like that, you know I was a lot more involved with it. [But you don't recall at least a meeting?] No, and I don't recall a particular moment.

10 For how long was the decision to implement Lean discussed, planned and processed before an actual implementation? *Blank*

11 What type of training did you get as the company decided to become Lean?

[22:18] [When did you become a foreman?]

That was back in '90s, with CBA, back in '96ish. [And then superintendent was at?] Probably around 2000s, around 4 years later or so. But I wasn't that involved with the scheduling between '96 and you know, because the reason being I was on large, very large projects where we had a super and general foreman and several foreman so that one foreman down here, so we were so occupied with the work that we were self performing.

[23:14] [So, even as a foreman then during those 4 years - did you get any type of training?] *Not that I recall. No. [It was more like brief just this is what you're going to do. Here's the schedule we want you to do this] It was a little bit, but nothing like we do nowadays. [But even when you were promoted to superintendent?] It was not an official thing. It was in some companies it may be like that but it was just kinda almost like a flex thing it just kinda happened naturally. I had to really push it I was acting as a superintendent functioning in that manner didn't really, so I had to be working in all of that and it was just like hey, I'm running several jobs and acting as a superintendent and that was it and they apparently thought I could continue to run work. [Oh yeah, obviously. So since it happened naturally it was not like, "okay you're the superintendent this is the training we want you to do"?] No, nope. And that's what I'm proposing that they do and I don't think they really do it per say and they absolutely need to do that. When I look back yeah, if I had had more formal training, all sorts of training, okay this is what supers do, here's how we run our show and what not. Never really had that.*

11.1 How frequently did you receive Lean training or at what interval?

[24:40] [So during these 14 years or something?] *Learned on the fly. Observation, and seeing what other people do, talking, asking questions, you know, that's probably the norm. I don't think it's the best approach by any means*

12 How would you have handled the transition to become Lean differently?

[15:22] [So you may advocate to pull people off their job for a day of training?] *Yeah, absolutely. Yeah, absolutely.*

[29:25] [So you mentioned a few things that you would improve if you had been the VP and introduced Lean to the company you would have had more training? Would you add anything else to help the transition of Lean?] *Oh absolutely. Absolutely training. And well certainly one thing. The LCI well, Lean Construction Institute, you know, part of the greater Lean I was able to go there two years ago and actually spoke at it myself and Fritz lead project manager and after I got done there I thought I'd like our people to attend those conferences. You know most company can't get their guys away, money blah blah blah. Let's say we got, well CBA's got like 20 Sups and central OPS its not like all 20 have to attend every single year but I definitely came back and thought, oh there was a lot I heard from other people, and now they're getting more superintendent's speaking at these LCI's conferences and its like there's a lot of interesting things you hear and see. [And then you feel more part of it too, right?] Yeah exactly. Yeah we presented about Takt Plan. So that's something I'd do. The LCI Conference and there's other training we do that's not really involved with Lean, ASHI training, not sure if you're familiar with that, but because we do a ton of hospital work and all of that and we've got a lot of guys that they could practically teach a class.*

[31:07] [What I've understood the big challenge is to actually get the foreman and the tradesmen to buy into it so how would you have made them part of the transition of becoming part of Lean?]

Well the journeyman I'm not sure, I mean I kind of, well we always preach "be efficient" part of it is actually being done through safety in terms of being Lean because different companies have different names we've got STA (Safety Test Analysis), its simply a card and then there's safety analysis sheet's also and they're always focused on safety but positive byproduct of that is that you're organizing your work. Your individual small task, whether it's installing a door putting on the hardwire and all that, "alright here's what we're doing today." "Alright here are the safety hazards," "okay how are you going to minimize them, alright" and then the process they're like "okay I need tool x y and z for that" and then they're not going back and forth 25 times. So that's a by product of safety that we're pushing and its got positive effect, theoretically it does. [Have you tried it?] Yeah we've been using it. And you know you can certainly see where there's failures. And I don't mean necessarily that there's a safety incident, you can see failures in production. And you can see this guy's going back there 25 times. It's like, what're you doing? Well, its like, had you filled this out this morning and actually kinda thought about your work for the day right, you know, we're talking smaller tasks.

[Do you think it would be helpful for the journeyman to be apart of something like LCI some type of training from the company? To help feel part of a big scale?]

Yeah, absolutely. Worst case it's going to make them feel a greater part of the company, right? Or team, the construction team. That's the least one would get out of it, I would think. Of course you want a lot more, but you know and then as far as journeyman and field personnel you get some that are very interested in that anyway and some that are just are only interested in doing that and then 10minutes from now my butts down the road. Right? So you try to continue to get people that are focused on their work and what not. Yeah I think there's benefits to that. I'm not sure exactly how we the program would do that but something that could be worked out. [Seems like that would evolve too.] Yeah, right. [You try something and if that weren't exactly right, you try something better.]

[Again, it's a balance thing. You don't want to over schedule, you want to train but they don't need to be on board with everything but they should know at least a little bit of what's going on.]

Oh and we've been talking about that with our Lean processes is that its not a square peg fits in every hole. Takt Plan is not a plan I use for more union, that's for sure. That job's a train wreck. I'd use Last Planner and a few other things. For the most part I think they're using Last Planner there. But Takt Plan would not work for there, in my opinion. Not everything works for every application. If you want to standardize you tell a couple people to standardize but with common sense. Don't standardize just for the sake of standardizing and kill yourself and shoot yourself in the foot.

PART 5: TRANSFORMATION

13 Can you describe the turning point when you understood the benefits of implementing Lean?

[21:56] *...nor even a eureka moment for me. [No?] No not that I recall. Like I said you're usually just so involved with what you're doing in the several of the projects during the 2000s are just an insane pace anyway and you're just so busy.*

[36:00] [So going back to your own experience, you said you didn't have a eureka moment, or an "aha" moment. Like did it take a few weeks, months? Do you feel like you had at least some point where you saw the benefits of Lean?] *Oh yeah. I know that's something that companies really care about. How long did it take for people to back it, really understand it, use it well. I really couldn't give you a decent answer. I mean it certainly wasn't a month or something, you know. You know its more so, I didn't really think that much about it. I would say that would be the answer. I didn't think much about it. It's like, okay I see the schedule, let's just go with it. [I think the really interesting thing is you're where we wish everyone was at, you know where "this is just all we know". "What other way is there but to do it the Lean way?" You know, most people aren't there. So that's where we'd like people to be is like, "what other system is there? Of course, we're just Lean."] Right. I'm surprised to hear that the Boston company with it's size... I even heard that the LCI was surprised, with it's pretty good size people that they haven't used it for very long on some pretty big projects. It's like I guess they just kinda had some kind of little schedule going but not*

much... Short Track maybe? [Yeah, they just had the old fashioned CPM. Where it's basically your job to beat all those Subs up and get them to do their job.]

- 14 How do you think friends, family, and co-workers see differences in your attitude and perspective of work after Lean was implemented? **[38:10]**

Well maybe professionally because it drives you towards being more organized, right? I don't know whether it made my disposition any sweeter but you would think it would because it made my job much easier.

- 15 How did work hours change? **[39:00]**

Uh...no. Not that I recall. I think where it probably helped but I didn't really quantify it at the time is that and I would think it would help is like we mentioned before is the construction team, so as the field leadership along and integrating that with the PMs and engineers. I think that probably, when I think about it Lean is really joining those two and getting them on each side of each other's fence. I think it was probably more integrated and more understandable.

- 16 How did Lean change the way you communicate and collaborate at work?

[39:50] [Yeah so it changed...Lean helped you to communicate and collaborate in some way? Is that what you're saying?] *Yeah I would say. Yeah I would say that'd be a good way to describe that.*

[40:46] [You said you're a little bit more team oriented when PM's like... jumping the fences. How did that happen? Was it just because of the Pull Planning sessions? Or in what ways?]

Well I would hope that first off, and this is outside of Lean, just having good people. Number one. I mean just having people that are...and I'm not the first one to say this, but two items and I put it crudely, but I'll put it nicely but just having people that number one know what they're doing and number two care about what they're doing. That pretty much will cover you through life a hundred percent. Those two and so and you get people like that and you get all sorts of different talents and you get a lot of collaboration, cooperation, teamwork, and planning and all of that and they have the devices, the Lean devices. I've been fortunate I mean you don't get along all the time with project managers or any of that but I've been. I may not be the best one to ask about that but that interaction because they think I probably have been fortunate. Because when PM's have been really good we've worked super together. We've always had a collaborative effort as far back as I can remember. But I know that is not the norm on everybody's deal. Some are just you know pretty bad I would think. I think it can only help. I don't think it can divide in general. Takt plan, kinda have a story about that, but.

- 17 What professional benefits have you seen within the organization by implementing Lean?

[42:57] [So professionally for the company have you seen any benefits by implementing Lean? Satisfied clients or if it's more Rework safety wise?]

All of those. Safety wise I mean and you do that with the planning in terms of safety, in terms of sequencing. Sure, sequencing its okay it's a natural progression of how a building has to go together but sometimes the sequences isn't rigid and then it might have to be dictated by, well "it'll be safer if we do that first. Right there, right?" And that does come into play. It's helpful so.

PART 6: IMPACT

18 Have you had someone mentoring you through this process of becoming Lean?

Yes No

19 What advice would you give to future Lean implementing workers in the same position that you were in?

[44:13] [So, I guess I already know this question, but have you had anyone mentoring you through this process? Or did you mentor, yourself, someone else at the time.]

Yeah I think a combination of the two that's where I think we could do a lot more mentoring. [Specifically with Lean?] A lot more, yeah. Specifically Lean. Other things too, but specifically, Lean. When I think about Lean, and this goes beyond Lean is that certainly Lean is that...I probably mentioned this, is that as a foreman when I was on my position and busy out in the field I really wasn't in a lot of meetings early on you know in the 90s or whatnot but now when I look back I said I'm trying to bring my guys in. I've got the one foreman that is always in the meetings. The other I've got on site. But occasionally I try to swap them or bring in both. It's a little tough because I want him to see what is up there, see what we're doing, hear what we're doing. Hear our thought process and kind of take that in so going back to how I was brought through I wish I had been brought into those meetings a long time ago, a long time before I was actually running them. You know, even some journeymen if you think, alright this is a guys that we're brought to lead to either sub-foreman or foreman just bring them in so we can kinda see. Because a lot of guys they used to complain all the time and they'd complain like, "Why the hell we doin' that there, there, there, there?" And its like, hey, just take it, you've got good leadership and you're not privy to everything. We can't make you privy to everything. We can't give you every tidbit. Why? Because we don't have the time! Are we going to sit down with, well if you have a job with 200 people are you going to sit down with every single person? So that's just like, and I think if you bring somebody in that's either one of your top journeyman or certainly even a sub-foreman that it'd be beneficial and then its like, "ah, now we understand." ...and that trickles down. And its like, "hey boys this is why they're doing that because that piece of machinery is not coming for another two months. Yeah, otherwise they're with you, they'd bring it in now, of course. But the damn thing is not going to be here." I think there's less of that then there used to be. I hear less of it, which is good, that means there is progress being made. You know unless there's complete incompetence at the leadership of the construction team or whatever its like "hey, you're just not privy to all the information they are. That's all."

[47:22] [You've already given us a lot of advice but my last question is what advice would you give to a person in your position, as a foreman or superintendent when Lean is implemented? Like, what advice would you give to them...?]

Well number one of course would be to have an open mind. It's not like you have to take this all in overnight, you don't have to learn it overnight, you don't have to accept it overnight. And know that now that we've had, well it was probably tougher back in the late 90s and early 2000s but there's a history here of proven success now so on one hand you want to say 'don't try to reinvent the wheel, we already have the wheel.'" So if they're bucking against this then, it's a proven deal, you know. But you wanna be collaborative so its not hey, trust me this works, it's been outstanding, I've used it, the company's used it for a long time and we've used it on this project boom boom boom boom you know and sometimes you may have some metrics like well we completed this three months ahead of time and you know, whatever, x number of dollars under budget and blah blah blah and you might throw out those things. But, generally its just hey this will make your life easier. That's really often what field personnel often want to hear. It'll make the job more manageable.

19.1 EXTRA QUESTIONS

[25:05] [Yeah, and I find sometimes in Chicago, maybe not as much now, but I have had some people say well that's the unions job, they're supposed to be doing that.]

I have heard that. Well see to my knowledge, yeah, the only thing the union. I'll have to ask a business agent when I talk to him again and some of the AGC people and stuff. Basically to my knowledge the union has the thought process its funny to talk about this sadly, because we talk about this in respect to safety, but to my knowledge they're just training journeyman they're not in the business of training leaders. And I don't even know if they would put forth that contention.

[You're right, you're correct. I visited the carpenters training facility in Chicago and you're right, I didn't hear them talk about any superintendents coming in for classes it was the apprentices and the journeyman.]

Yeah and now what they do they have classes for things that superintendents and foreman will do, layouts and things like this, but they teach journeyman that as well. So to my knowledge, they're only focused on making a journeyman that's physically doing the work. You know and educating a worker in how to do everything in the carpentry world, not necessarily acting as a foreman. Which, I haven't been involved in that enough, I'm not a big union guy, I'm in the union of course, the carpenter, but I'd be interested to know whether they actually have a program that's like okay foreman or something. I would say no.

The safety part of it what we were talking about and I think I was talking to some of our higher ups at CBA about this, in fact he took over our president our central operations Darwin, I don't know if you know Darwin or met Darwin, he was in our risk management our human resources out of Alabama he recently took over for Elmer, have you ever heard the name Elmer? He was a former president of ours. So anyway, we were talking to him about this, talking about safety, and ultimately if you can get the unions to help with safety okay when they train a worker sure they discuss safety but how much they do it compared to what company's do it internally now, I think it could be a lot more. That's certainly something that they kind of sell I would think and that's the point that I made to Darwin and other superintendents well its like, "aren't that selling that?" As okay our union trade personnel journeyman as opposed to nonunion carpenters well here's why we're better because we're better educated, more knowledgeable, more productive, and safer. Right? I think they are safer but how much they do I don't know. So when we're talk about improving safety in the company it starts from the top of course and especially in the field the superintendents can direct the whole culture and all of that but really the best results are going to be when you have journeyman that are really well trained in the safety area and give a damn about it. Right? You're not going to get any results compared to that, that's going to be your best. And that's what they're trying to get the unions to do. But what I heard back is the union have no interest in that, that's your job. It's interesting what the union says it's a whole another deal.

[49:18] [So whose idea was the Takt Time?] *Well, the idea of Takt was Casey's. Yeah, it was Casey's. I wasn't there at the first – the genesis of it but I had heard about it and as I heard that Casey was gonna come and also our western ops guys, western operation in Cincinnati specifically had already started to use Takt Time and experiment with Takt Time. They had used it for their enclosure and I think they said they tried to use maybe just a little bit as part of the foundation package. I think it was really the enclosure and that was Gabriel, he's in Western ops. He's like a continuous improvement guy that works with a lot. You know, Casey is here in Dallas. Gabriel is from Sweden I believe. So, they're using this particular deal in Elmhurst – we might try to use it here. Then they came for a meeting and the first introduction was – pretty much what I was talking about... The superintendents on the field being the magic people making things happen. We had a long discussion about it and well, it's more of a rigid Takt Plan and I don't know that much about Takt. I had to go through some of the concepts. Takt, it's like a metronome – the pace. So, I'll give you a short deal – the whole deal is kind of like the way I view of it... the fine predictive process, taking the Last Planner and refining it even more. It's not quantively, and it's not for everything... but it's really perfect for repeated work... So, it's just like pacing yourself through. So, I remember saying "well, what this I what Superintendents have been doing forever". It's pretty much guiding*

people through the building. It just wasn't on paper, we were kind of doing it out in the field. There were a lot of different opinions on whether it would work – I think the biggest thing was to try to grasp the concept and the big thing with people, I try to present it at Sups meetings – Hector, the VP, gave a 5min summation and afterwards... the problem with that is that create a lot more confusion. You can't... I hope I don't end up confusing you with the 5min summation, cause they pretty much like "wow, it's a big deal" but how was this drastically different from what we're already doing? I don't know if you want your bullet points to be "it works well" and from a superintendent and a field person's stand point, when I was talking about a sup guiding things – no matter if it's with the Last Planner or not – I barely have to guide anything on the field. I mean, the difference is amazing. I still gotta yell a little bit here and there, but especially the MVPs and even the others haven't sold out – it's pretty much like clock work.

[54:18] [Takt is sort of though of as: working at the pace of the demand. So, I'm wondering how do you determine what is the demand?] *Right, and we went through several meetings and durations, once we had a schedule. That's the other thing that Subs don't like: you're going up and down like a jojo – go over there, go over there... So, you're constantly adjusting the personnel and kind of... the whole thought process is that, try to make all the trades and activities the same period of time and in this case, if we want to finish in one week our takt would be one week duration for a particular defined area, what we call sector. They should've used sections, most of the guys call it sections anyway. That will vary depending on the activity. So, early rough-in and stuff like that, above ceiling work – the nature of that work requires a different direction. It requires a different takt, a different quantity of time for a variety of work... Especially their early work where they got the big ductwork or what not and want to put up a little piece like this and then you put... So, I don't know if you recall seeing, and I don't know if anybody use trains – but we had something called trains – like A, B, C, D... originally we had three and essentially A is early work, ceiling and stuff like that, B is kind of running the branches electrical and priority walls and such... That's what on the early trains... Once we hit train C, which was the majority of the studs and all of that.*

[2nd 0:00] *I'm a big fan of the visual and the boards... So, we're only focused on those two weeks and put them on there for those two weeks and we just focus on that activity. We look at the others, but normally with Last Planner you go through all the items for the six weeks, right? It's like let's not bother about those four, we don't need to go crazy with that – let's just focus on this two weeks and it works super well and you can get through the meeting faster.*

[So, do you still have all your activities, but each activity has their Takt Time?] *No, each activity has a, maybe a day or something, but the Takt is really one week. So, we have two boards – one is for one week, one is for the next and then we have individual days, and when I'm in a meeting I'll take a post it note and the guys... this is way back – when it's going, it's going. So, and this is the real deal and I explained it at the LCI conference. One of the problems, even with Last Planner, is how do you integrate that weekly, once-a-week job meeting with the daily performance. How do you integrate those? Now, if you have a job where it's run well and you have the right device that you're using, integrated seamless, right? They'd better reflect each other – otherwise you got a major problem. I've been on jobs when it's not even close and not even on our jobs as well as it's been, sometimes it's like... that's when we found out that when we're going through there to make sure that some contractors they're... when we're going through that they have a Takt that - they have a sticky that they put on there and then we approved it even better because we have committed early and they do that all on their own. You know, all we do is kind of check if we got a problem with that. I mean, when I was, not right now cause we got a lot of other schedules that makes repeating longer but I've had some Takt meetings that were, and for a large amount of work that were about 30-35 minutes. I guarantee that for a building that size, there's some people out there that have 2.5h meetings. Sometimes I'm have to remind the subs how good they have it because they're like "we got to go through this?" – "it's been too long since you've been on another job*

so I can't wait until they go to another company or a job where they can sit in there for 2h and then they gonna realize how good they had it.

[So, it has been well received with Takt] well, initially it wasn't. There was a lot of push back. I mean, I think some of these guys weren't really that exposed to Last Planner. Some were, whether with our company or other companies here in town. Some have a really basic attitude "tell us when you want us to be done". It's really bad, right? And people get really negative and cynical – this is why collaboration is so important cause it's like from their standpoint it's not just that there is some negative attitude cause they were forced into that position by other companies. I think maybe in the past they wanted to be more collaborate, a particular person foreman for a MEP company – it's like I tried to do this with another company, not Takt, Last Planner or whatever, and I worked with them and they pretty much showed it down my throat anyway. It's like "hey, I need a week" well, "we don't care – we'll give you two days" and that happens. That's not even touching on Last Planner – that's just for common place interaction. Not everyone was like that, but there were a few and others care about what you're saying. It took some time and the ones that were used to Last Planner, the Takt time itself took a lot of time. I probably don't understand a 100% now. Okay, we got the cars, then the train, how do you evaluate that... I certainly know the concept and the culture and the thought process behind it.

[Does Takt Plan help the subcontractors to leveling their workload?] That's a good statement, that's one of the words there, phrase that is used often "leveling the workload". That's one of the objectives we try to achieve. Here's another thing that Take Plan hasn't achieved like other systems, it's just so hard to – even when we sat in those first meetings, we had all the trades and all this, not just MEPs which is similar, but you got the drywalls, the flooring guys, all that. Their work is a lot different and we didn't want to process this so we have to... this guy might want to Takt one week, this guy want to Takt two weeks, and this guy wants a Takt of four weeks, this guy whatever and another thing, this flooring guys are like "I don't want the building split into corners this way (quadrants). I want it that way." That works great for flooring guys, he's running straight lines not bouncing between rooms, but going across... he's just breaking a long white, it doesn't get any better than that. Same with the ceiling guy, I'm gonna stich my stuff together and won't go here, here, and here. I want to run this entire long rectangle – so, he kind of have to come to a meeting like mine where. We actually did change it for flooring and ceiling guy and made it work. The other guys worked mainly in squares, in lack of better words and while the other guys did long rectangles. It worked. We had a separate mini schedule for them – it was incorporated into Takt and it was on there, but we had a little print out color course and all of that - that showed exactly... bombbombomb in sequence and we continued to go over it and eventually you get everyone in a pattern – "you gotta clear your stuff up". You still gotta do a lot of that, which is painful – it's like I don't need to tell ya – the tile guy, the flooring guys go into that "okay, come Monday". That means at the end of Friday it has to be clean. It's a happy medium, I mean trying to get the right Takt, the right amount of time, and even the pathway, the number of sectors, the size of the area.