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# **A Case Study in Lean Construction: Baker Concrete**

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## Summary:

Baker has been successful in its deployment of lean through a balance of its core values with lean principles. Combining this cultural fit with ongoing, disciplined training in fundamentals for their operations, not only empowers employees but encourages them to strive for improvement in their careers. By defining key processes in their Baker 3.0 Operational Model, Baker has established a platform to spread their best practices as the standard operations. Through this standardization, they are able to embody their core values in their standards and processes. This results in transparent procedures, better communication, and empowerment of the workforce. However, the important feature is that Baker strives hard to balance standardization and continuous improvement. Numerous examples of these techniques were observed in their office and job site, such as detailed weekly work plans.

Baker employs visual management and production analysis in their weekly work plan (WWP) to inform all employees to realize the current status of any project with one glance. By standardizing the visuals across all projects, the general superintendent who visits the job site can easily understand how they performed in the past week, what constraints they encountered, and other useful information, such as current daily tasks.

In addition to these techniques, Baker employs metrics to track and analyze their performance in different areas, including quality control, safety, schedule, and efficiency of craft. The massive use of data analysis is one of the remarkable aspects of Baker's lean journey, indicating that they focus on the entire circle of PDCA by constantly measuring and evaluating their processes and seeking improvements on a continuous basis to make adjustments using the best available data.

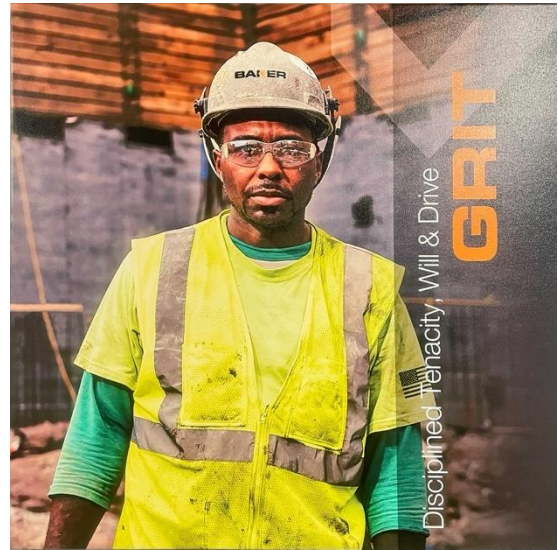
# Company Overview

Baker Concrete, founded in 1968 in Oxford, Ohio, is one of the nation's leading specialty concrete contractors, performing a variety of project types, from traditional concrete placement and finishing to specialty floors and concrete surface treatments, as well as repair and restoration.

Their corporate office is located in Ohio. With regional offices across the country, namely Colorado, Arizona, North Carolina, Texas, Florida, and Washington, DC, they are positioned in their core markets: commercial, industrial, institutional, residential, and civil projects.

By treating coworkers and customers like family, along with putting family first, they define their goals, decisions, and actions to create a better future for everyone who comes in contact with Baker Concrete. Consequently, Baker defines its **core values** as:

- **People** – Practice the Golden Rule: Whatever they want the Outside Customer to feel, their Inside Customer must feel first.
- **Honor** – They are dedicated and make decisions that allow operating at the highest standards of compliance and integrity.
- **Grit** – For over 50 years, disciplined tenacity, will, and drive have been key drivers of Baker Concrete.



**Service Areas** – Baker is a specialty concrete contractor concentrating on three cohesive service areas: Construction, Preconstruction, and Project Management. In their Construction services, they provide core concrete scopes, such as structural excavation, concrete formwork design and installation, reinforcement installation, and concrete placement and finishing. In parallel, their preconstruction teams have significant experience with all types of concrete construction, providing preconstruction services for their clients that include conceptual estimating, project scheduling, as well as design-assist and value engineering services. In the execution of their projects, their project management spans four service areas: (1) safety, quality, productivity management, (2) materials procurement and logistics, (3) field engineering, and (4) extended package management.

**Scopes** – Baker has many years of experience performing all types of cast-in-place concrete in a wide range of market segments. Their main markets can be listed as follows:

- **Civil:** transportation and water resources projects
- **Commercial:** sports & entertainment, distribution and warehouse, parking facilities, office, retail, hospitality, and mission-critical projects
- **Industrial:** power and manufacturing projects
- **Institutional:** healthcare, education, and justice and security projects
- **Residential:** Multi-family projects

# Case Study Process

In late September 2021, the case study was undertaken through a two-day visit to Baker Concrete Construction in their Washington D.C office, including visits to two construction projects, their headquarters in the D.C region, and Baker Equipment And Materials (BEAM) equipment yard, serving as the prefabrication and production facility. During the visit, the researchers interviewed a wide range of company personnel from leadership, operational management, and field and project management, along with site personnel, including project engineers, to understand how the behaviors and approaches to lean are implemented to support their operations.

In addition to interviews, the tours of their two job sites, the office and BEAM facility, served as observational data collection, helping understand their ongoing operations, document how methods were implemented, and observe the company culture and the behaviors of personnel in the implementation of lean methods.

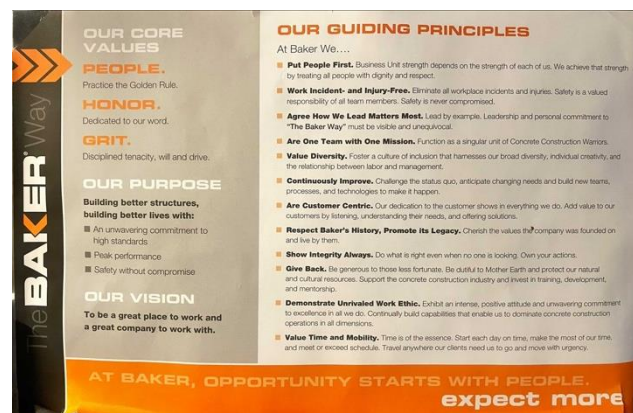
## Overview of Lean Construction Implementation

The case study aims to understand how successful trade contractors implement lean methods and principles in their organizations and how it affects the way they do their business. The point to emphasize is that each organization has its unique characteristics and work procedures, resulting in different operationalization of lean principles and methods. Therefore, it is crucial to understand how lean principles can be framed in any trade contractor operation to support eliminating waste and continuous improvement in delivering customer value. How can the methods and behaviors be instituted and supported in a sustainable way?

### Alignment of their core values and principles with Lean Principles

Baker operates based upon its company core values and guiding principles, which are in close alignment with lean principles. This similarity allows continuous improvement to be easily grounded in how Baker does business, treats people, analyzes their operations, and achieves the company goals. As a result, these fundamental principles guide all the company personnel to adopt the right behaviors and procedures. These principles are:

- Promote the Incident and Injury Free (IIF) culture,
- Pursue perfection and excel in what they do,
- Promote honesty and integrity, along with respecting individuals and operating as a team
- Provide leadership for continual innovation and improvement
- Contribute positively to the industry, and practice frequent open communication
- Conduct themselves with professionalism
- Deliver on promises



These principles closely correlate with lean principles, such as respect for people, perfection, and continuous improvement.

**Respect for people:** Baker teams are committed to putting people first by treating everyone with dignity and respect. They believe that the strength of the business unit depends on each person's strengths, and by treating people with dignity and respect, they can achieve those strengths.

**Teamwork:** Functioning as a singular unit is emphasized in their operation. Baker fosters a culture of inclusion through their teamwork to harness their broad diversity, individual creativity, and the relationship between labor and management. Baker also emphasizes investing in training, development, and mentoring to enhance their teamwork performance. Baker further empowers workers and harnesses their willingness and drives improvement.

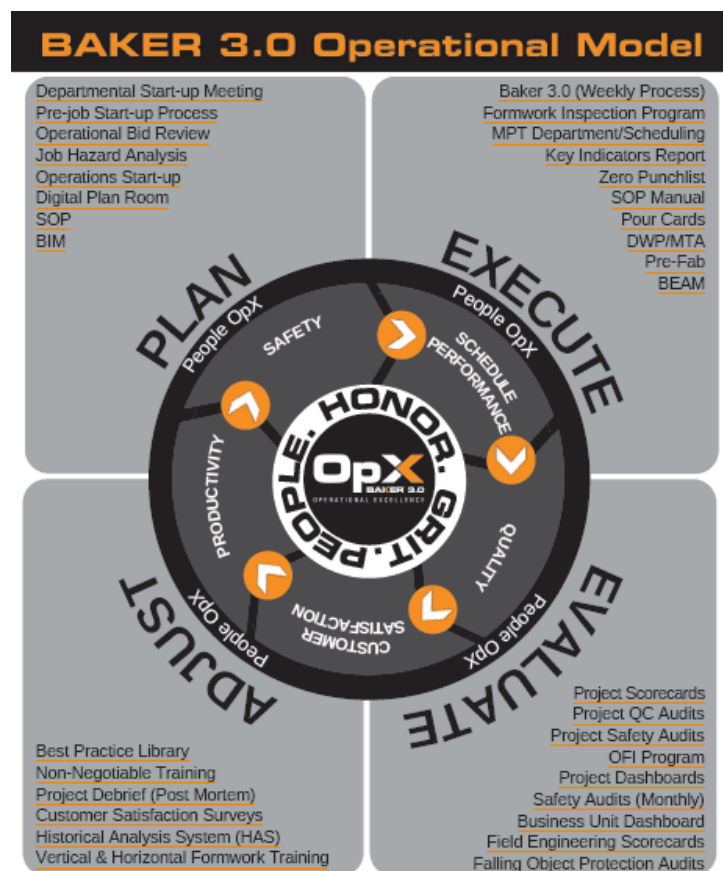
**Continuous Improvement:** Baker constantly challenges the status quo, anticipates changing needs and builds new teams, processes, and technologies to make it happen. This is exactly what is emphasized as the “continuous improvement” principle of lean construction. They are committed to excellence in all they do by continually building capabilities that enable them to dominate concrete construction operations in all dimensions.

**Customer Orientation:** Baker teams are committed to delivering better value for their customers through showing great dedication to the customer in every aspect of their operation, from listening to them to understanding their needs and offering solutions.

### Baker 3.0 Operational Model:

Baker’s lean journey started with lean construction when three of the managers went to the LCI Congress and heard “the message.” In the beginning, it was all about working hard to beat the competition; however, by understanding lean philosophy, they realized that by having the right people with open minds and considering different methods for how they do their businesses, they could achieve success. As a result, establishing their Baker 2.0 operational model was a major transition point along their journey to Lean.

After some years of standardizing their operation and seeking continuous improvement, Baker developed the upgraded version of their operational model, dubbed “Baker 3.0.” This model, which was developed through continuous iterative reviews and consensus building using the PDCA process, helped them refine and document standard operating procedures to ensure each step of their process is conducted in the “best way.”



In addition to creating the ‘instruction manual,’ the model includes an evaluation stage to audit their operation to ensure their processes and core values are being implemented properly through re-visiting, checking, analyzing, and implementing it (PDCA). This model is reviewed and updated continuously, ranging from once a quarter to once a year, depending on the process.

Baker crafted this model for both defining and communicating their approach for their operations. The model captured the core principles, methods, and processes they have found to be consistently valuable in their lean implementation. Based on the PDCA process of continuous improvement through the lifecycle of a project, the operations are approached through four phases: Plan, Execute, Evaluate, and Adjust. The Plan phase characterizes and establishes the standards that support their operations, such as Departmental Startup Meetings, Pre-Job Start-up Process, Operational Bid Review, Job Hazard Analysis, SOP (Standard Operating Procedures) Manual, and Operations Start-up. Through resources, such as simple checklists and agendas, they capture the standard elements needed to ensure a comprehensive and consistent approach required for each step in the preparation and planning of a new project.

**Project Name and Project Number**

**DATE**

**Objective of Place/Finish startup meeting:**

- Address any concerns and answer any ques
- Create a successful plan for the job and P/F
- Arrive at an understanding of all responsib

**Agenda:**

1. **Key Personnel** (all individuals attending the)
  - Project Manager/Click or tap here to en
  - General Superintendent/Click or tap her
  - Superintendent/Click or tap here to enb
  - Project Manager/Click or tap here to en
  - Place/Finish Manager/Click or tap here t
  - Concrete Superintendent/Click or tap he
  - Project Engineer Place/Finish/Click or ta
2. **Schedule**
  - By COB The Thursday Prior To The L
    - o Start times we desire
      - Any major slabs/fo
      - Start all placements
    - o Square Footage or pour nu
    - o Floor Finish Required (hard

**BAKER | DC**

**Departmental Startup Meeting**

Project Name \_\_\_\_\_ Meeting Date \_\_\_\_\_

Project Number \_\_\_\_\_

Meeting Checksum \_\_\_\_\_

Project Designer (Contact) \_\_\_\_\_

**PROJECT SUPERVISION:**

Operations Manager \_\_\_\_\_

Field Engineering Manager \_\_\_\_\_

Project Coordinator \_\_\_\_\_

Project Manager \_\_\_\_\_

Project Engineer \_\_\_\_\_

General Superintendent \_\_\_\_\_

Superintendent \_\_\_\_\_

Job Chief \_\_\_\_\_

**EMBEDDED TEAM MEMBERS:**

Name or Classification	Full Duration (hrs)	IF/IO Duration (Weeks)

**ONGOING WEEKLY BIM PROGRESS MEETING**

Project team review and discussion on open issues, as built incorporation

Attendees: BIM/DC Engineer, PM, PE, Sup, FE Coordinator, Party Chief

What day of the week will this meeting take place? \_\_\_\_\_

**MODEL DEVELOPMENT LOD - Select One**

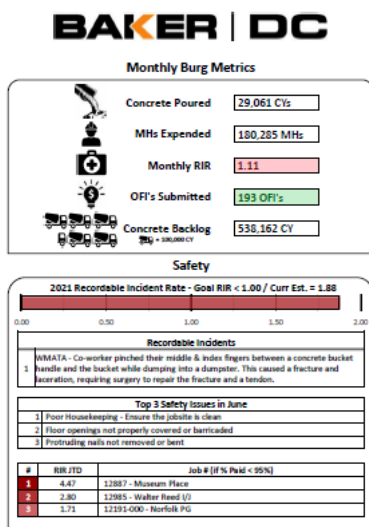
**BIM LOD 300:** Model developed to be dimensionally accurate to intended to be constructable (i.e. not to be used for layout); no mass onscreen field engineering team required.

**BIM LOD 350:** Model developed to be dimensionally accurate and intended to be constructable. Field engineering team will check and verify the model is fit to be used for layout. Model will be maintained with collaboration from field engineering team.

**AREAS OF CONCERN/CONGESTION TO BE REVIEWED FOR CONSTRUCTABILITY ISSUES, EMBED & BOX OUTS**

## Departmental Startup Meeting Templates and Standard Agendas

At the Execution phase, the model highlights the standard procedures for performing each process or procedure, such as the weekly planning process to provide an overview of the project in the next two weeks. By employing visuals, they simplify the standard processes to overcome any confusion or misunderstanding regarding daily activities. It enhances their performance, resulting in a reduced learning curve on new projects. In addition to bringing consistency and connection between teams through



standardization, the documented processes help them turn their best practices into the company's standard practice. By analyzing the data, they can also understand their efficiency to develop new solutions for common challenges across projects and how they can improve.

While using standard boards and processes acts as a company-wide guideline, their main goal is to balance autonomy and standardization, not limiting the employee's innovation and creativity but rather making the work procedures routine. To ensure the guidelines are properly aligned with their tasks and values, they review them based on the feedback from users and add their insights to apply adjustments as needed.

Through the evaluation phase, they measure each department's performance against the plan or targets. They also use a project scorecard as a measurement metric for project-level evaluation from

different perspectives, such as cash flow, quality control and efficiency. They have a slogan that “ If you measure something, it will improve. If you measure and share, it will improve exponentially.” Based on this, they try to measure and share their performances across projects frequently. In this way, senior managers can see performance on all projects and realize how each region is performing.

To crowdsource their continuous improvement, Baker has an in-house app to capture opportunities for improvement, in line with the ‘Andon cord’ concept from Toyota. The app is provided to each employee to report an issue, from a challenge found on a project to a quality issue, to an area that they could simply do better. These are reported through the app that can be easily accessed from each worker’s phone. It allows Baker to surface their problems, identify trends, evaluate them, and provide solutions across the company. They find this extremely effective to surface or developing new best practices. This program is a close correlation with Continuous improvement and seeking perfection principle of lean.

Ultimately, in the Adjust phase, they document their after-action reports on performance, metrics such as labor per CY, among others, to develop a database for their future analysis on bids and planning. It includes financial, schedule-related, quality, and safety data for historical analysis. They also document the output of OFI as the “Best Practice Library” to accept and adopt them as new standards across the country.

The lean operations within Baker are not led by a specific lean department or lean director, rather by having a lean mindset and related principles in their company, which are embedded in every aspect of their job. Under this mindset, it can be argued that Baker tries to educate and mentor all employees as a lean champion.

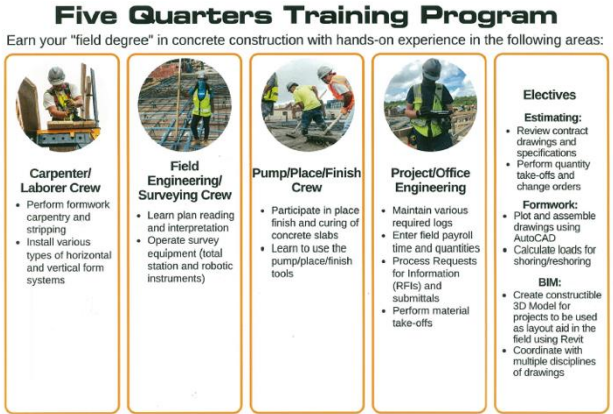


2021 YTD thru June, by region						
Region	All YTD OFI's Submitted	YTD "Compulsory" OFI's Submitted	YTD "Compulsory" OFI's/Week	YTD OFI's / PM/Super / Week	Only PM/Super OFI's	# of PM's & Supers
Baker DC	1,189	340	12.59	1.42	241	31
Central Florida Operations	37			0.11		12
Dugan & Meyers	421			1.42		11
Greater Atlanta Region	6			0.04		5
Northern Operations	160			0.74		8
Rocky Mountain Operations	107			0.10		40
South Florida Operations	145			0.08		65
Southeast Industrial	65			1.20		2
Southern Operations	0			0.00		47
Southwest Operations	67			0.11		22
<b>Totals:</b>	<b>2,197 OFIs</b>			<b>0.24 OFIs/User</b>		<b>339 Users</b>
No Gen. Supers or Sr. PM's						

## Training and Education

The core of Baker’s training program starts with their “Five Quarters” program, starting as early as an intern or co-ops, all employees earn their ‘field degree.’ They offer five fundamental pieces of training, including carpenter/laborer crew, project engineer training, line & grade, pump/place/ finish, and estimating, with some elective options such as the BIM group. This builds a core knowledge of the value-adding processes at the heart of Baker’s business to build their future career path.

In addition to this program, all team members participate in ongoing training and mentoring to ensure all employees understand the Baker 3.0 operational model and procedures. They are developing “PM Academy,” provided as a resource to all engineers, as part of their PDCA. Their PM / PE training has evolved over the last ten years. If Baker hires someone into a role who is not initially developed based on their five quarters training program, they pair them with an experienced person for a period of approximately six months to support their transition. They also developed “Field Leadership Academy,” which is objective, task-oriented training. However, they shifted it to the foreman level as they have the most influence over the workforce, in an attempt to support the development of their burgeoning management skills and related soft skills.

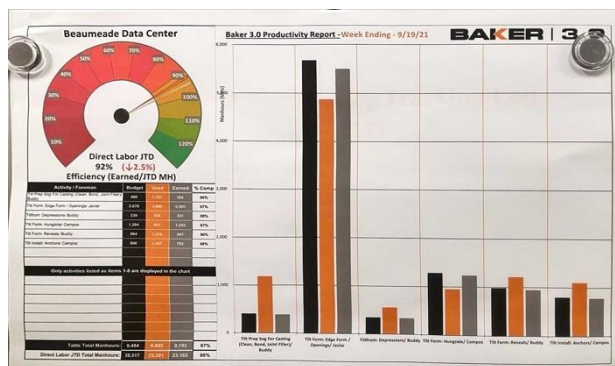
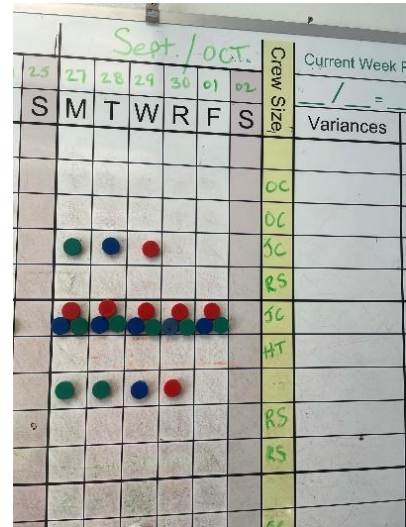


Baker also employs the “Study Action Team” approach, with a rolling training using The Toyota Way to introduce the philosophy of lean as personnel move toward leadership positions. The training mixes office and field personnel, typically including about eight people, to get the required pieces of training 3-4 times per year on a continuous loop. Some employees re-take it as a refresher to lean philosophy.

## Lean Methods emphasized

In adopting lean, Baker focused its efforts on targeted lean methods that support field production planning and organization, as well as standardization.

- **Weekly work plans:** the use of the WWP was a fundamental method applied consistently in Baker’s projects. Beyond the training and understanding of all elements, they took the weekly work plan as a key element for engagement with field personnel. In addition, there is time spent discussing probable constraints that resulted in poor production. By surfacing these constraints, they can come up with solutions to overcome them to reach their efficiency goals for the next week. Through these meetings, tasks, materials, constraints, and other concerns were discussed within the team, bringing up contingency plans and materials/equipment orders.



- **Standardized Visuals and reporting:** In their WWP meetings, they report the productivity of their craft for the week, evaluating their labor efficiency and comparing it with the last week as well as the forecast production, to see how they are performing. In addition, the visuals for the WWP and production status are standard visuals that allow anyone from Baker to walk into a job and recognize how well the project is meeting its targets, as well as current activities.

- **Identifying Waste:** Baker emphasized enhancing the craft awareness of the waste and how to identify and eliminate it. Using this simple approach empowers the field to improve processes and remove waste before it impacts projects.

- **Kanban and Visual Management:** By using an indicator for their consumable materials, such as nails, and rather than realizing that you are out of nails, go to Home Depot to supply your requirements, they train the craft on how to use the Kanban system for their materials and consumables so they can manage their production processes in a lean way! For example, by using orange stickers on the nail boxes, the worker realizes that they have a limited amount of nails and need to order more. They also apply different visuals in their job sites, such as colored WWP which uses set colors for each of the main steps of forming, reinforcing, pouring, and stripping. This simple but effective visual management method was applied to support effective communication or tracking. Furthermore, they use color coding for their beam storage in their BEAM yard as another proper use of visual management.



- **Standardization:** standard work was used in creating consistent approaches, resources, agendas, or other processes that could be easily ported across projects. They have standard agendas for their start-up meetings, along with checklists for their core procedures to ensure all key topics are touched on related to daily planning, constraints, lean thinking, and safety. Weekly work planning documents were standardized to keep them simple but structured to align with budget and material planning needs. Standard bins that stack and can be easily craned into place further help in the easy and consistent management of materials. In conclusion, they apply standardization in many aspects of their planning to control their production more effectively.

- **BEAM:** Baker has nine yards nationally for mainly managing their ordering systems for consumables, cranes, forms, concrete buckets, trucking, and other equipment elements. Their main focus is to be the low-cost provider so that their business is profitable. By controlling and managing their ordering systems and consumables, and equipment, they can achieve this goal. In addition to this role, the BEAM facility helps Baker document orders and pricing, making it a good data source for their future projects.



# Concluding Thoughts

Throughout the visit, interviews, and discussions, there were practices and supporting ideas that personnel and project team members noted as barriers and enabling concepts to the use of lean. The following sections capture a few of these items:

1. **Emphasis on standardization** –the core value of all their checklists and procedures is simplifying the standard processes to bring consistency and overcome any confusion between teams. The focus is put on supporting the craft and their leadership in effectively planning their work. The planning engages the field leadership and the craft workers to focus on the upcoming weeks' work, locations, crew, materials and tool needs, and identification of constraints that will keep them from being successful. The information is captured in a consistent form allowing personnel across Baker to understand the status and needs of any project across the company.
2. **Lean is everyone's responsibility** – The lean operations within Baker are not led by a specific lean department or lean director, rather by having a lean mindset and related principles in every aspect of their job everyone is empowered to pursue continuous improvement. Under this mindset, it can be argued that Baker tries to educate and mentor all employees as a lean champion. Through the case study visit, it was evident that they tried to inhale lean philosophy into the company's core culture, emphasizing the long-term philosophy of Toyota Way, even at the expense of short-term loss. Baker seems to have struck the right balance between the lean culture and philosophy and technical methods for applying lean principles.
3. **Improvement through Transparency and Measurement:** In order for continuous improvement within the lean approach to be successful, there need to be methods for recognizing and measuring how effectively new processes or approaches are relative to the baseline. Baker emphasizes tracking their efficiency and production, along with numerous other metrics, which helps them surface their problems and constraints to solve their issues.

## Other Observations

**Knowledge sharing** – an ongoing challenge of any construction firm is how to best harness the array of knowledge distributed throughout its people and then find and apply that knowledge when and where it is needed. As a construction company grows, this challenge grows exponentially. Effective knowledge sharing, similar to continuous improvement, is about the constraint pursuit of perfection with the recognition that it is a journey rather than a destination. Companies are, in some senses, a network of people. In project-based industries, like construction, that network is often pooled into project teams. Knowledge sharing occurs through these networks and connections. Finding methods to increase the interconnections in meaningful ways creates the 'infrastructure' and expands the capacity for knowledge sharing when and where it is needed.

**Enriched guidance** – the capture of data in the scorecards, appears to be well shared across the 'burgs' as well as used to monitor progress. The opportunity to use the data to better characterize and teach project teams what good and great, projects look like appears to exist. Using the scorecards, and the other documents used to develop the project management plans could be re-structured to present clear examples and cases to help guide project teams from good to great performance at each of the key stages.

# Acknowledgments

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