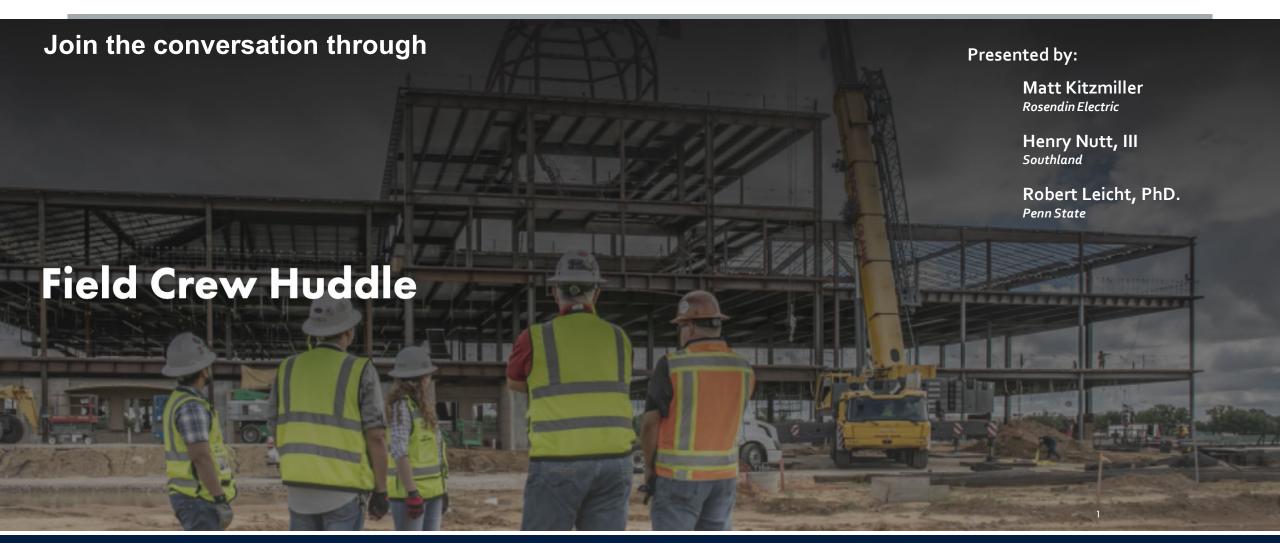
### Trade Partner Handbook of Lean Construction Methods







### **Presentation Team**



Henry Nutt, III

Preconstruction Executive Southland



Robert Leicht, PhD

Associate Professor Penn State University



**Matt Kitzmiller** 

Lean Trainer Rosendin Electric

October 20, 2021





# Objectives









01.

Participants will understand the benefits of lean adoption specific to trade partners

02.

Participants will gain familiarity with common barriers that hamper adoption of lean methods

03.

Participants will learn about the process and resources in the Trade Partner Handbook of Lean Methods 04.

Participants will learn through a case study how to incorporate best practices for adoption of lean methods.

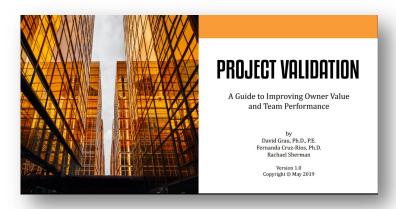
## Trade Handbook is part of LCI's Research Portfolio



https://leanconstruction.org/resources/guides/







## **Project Summary**

### **Goal:**

Understand the mechanisms that support adoption of lean methods by trade contractors through detailed interviews and case studies, and develop valuable resources to support their expanded adoption.

### **Metrics:**

- Increase in trade contractor participation in LCI
- Increase in Lean adoption by trades
- Presentations and outreach to trade organizations and through embedding content into LCI educational offerings

### **Project Steps**

Perform interviews to recognize the barriers in adopting lean methods by trade contractors

Conduct case studies of successful adoption to profile the processes and business impacts

Identify high value and easily accessible lean methods that can be readily deployed by trade contractors

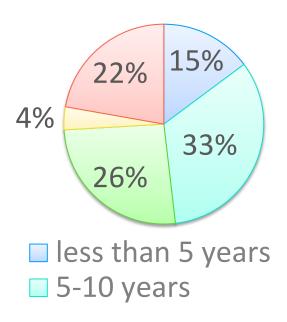
Develop and disseminate practical resource(s) that support adoption and grow trade interest

# Background – Lean methods for Trade Partners



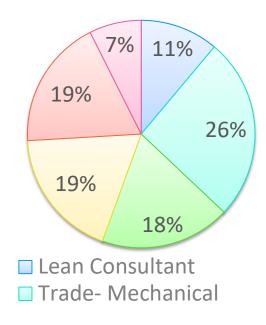
## Diverse pool of interview participants

### **Years of Lean Engagement**



Years of lean engagement	Number	Percentage
less than 5 years	4	15%
5-10 years	9	33%
11-15 years	7	26%
16-20 years	1	4%
more than 20 years	6	22%
Total	27	100%

### **Specialty**



Specialty	Number	Percentage
Lean Consultant	3	11%
Trade- Mechanical	7	26%
Trade- Electrical	5	19%
Trade- Finishing	5	19%
CM/GC	5	19%
Industry Representative	2	7%
Total	27	100%

17 trade respondents

### **Geographic Distribution**



(The dots are representative of that state not the location of interviewees)

Total # of Interviewees = 27 Trade Partners = 64%

## Methods Trade contractors most frequently use:

Most cited methods (by Trades):

- 1.Last Planner / Pull planning (100%)
- 2.Daily huddles (50%)
- 3.Prefab / Modular (33%)
- 4.Gemba (25%)

Functional categories	Methods	Frequency of	Percentag e		
	Daily Huddles	8			
	Gemba Walk	4			
	A3 Thinking (PDCA)	4	i I		
	Choosing by Advantages	2			
Organization	5 Whys	2	34%		
Methods	Onboarding	0	34/0		
	Work Clusters	0			
	Spaghetti Diagramming	0			
	PICK Chart	0			
	Quality Circles	0	L I		
	Last Planner System (and sub) + Pull Planning	17			
	Modularization/ Prefabrication	5			
•	<b>5</b> S	4	l .		
	Project Condition of Satisfaction	3			
	Virtual Management	2			
	Target Value Design	2			
	Standardization	2			
	BIM	1	1		
Operating System	Big Room Planning	1	66%		
Methods	JIT	1	]		
	Poke-Yoke	0	1		
	Set-based Design	0			
	Design Structure Matrix	0			
	Agile Planning	0			
	Value Stream Mapping	0			
	First Run Studies	0			
	3P	0			
	Takt Planning	0			

17 trade respondents





## Benefits of Lean specific to Trade Contractors

### Most cited benefits (by Trades):

- 1. Happier people/employees
- 2. Improved collaboration
- 3. Enhance safety

- 4. Increased productivity
- 5. Worker empowerment
- 6. Deliver project on time



## Barriers to trade adoption of lean

### BARRIERS (TRADE PARTNERS PERSPECTIVE)



## Case Studies – Industry Leaders



ARCHITECTURAL ENGINEERING

#### A Case Study in Lean Construction: Rosendin Electric

By Robert M. Leicht John I. Messner Elnaz Asadian

Sponsored by

Lean Construction Institute, ELECTRI International, New Horizons Foundation, and John R. Gentile Foundation

Case Study No. 01 September 2021

@Copyrigh

The Pennsylvania State University Architectural Engineering University Park, PA 16802 workers do cut down their need to handle and carry heavy materials. The carts can be easily shifted between areas to keep them close at hand, and they are wheeled and easily movable – so if they happen to be in the way of another trade or group, it does not take much time or effort to move them.

#### Organization of material storage and visual management

They organize and store typical or prefabricated parts, such as Unistrut cut to typical lengths. This helps the materials to be sorted at their shop facility in a more organized manner and ease the delivery process to the sites.

Their job boxes are usually organized, which are combined with visual management technique. Different parts are sorted under categories, making the finding process much easier for the installer. They also establish a "Grab and Go" kits for the installation process on the job site. Under this strategy,

They also establish a "Grab and Go" kits for the installation process on the job site. Under this strategy, all necessary tools and small parts for a specific electrical task, such as running %" conduit, will be sorted in a kit so that workers on a given task can grab the corresponding kit and have all the necessary items.



Trello as a virtual Kanban board: The shop uses the Trello board to manage the day-to-day production. The prefab shop receives orders through email and posts them to the Trello board so that the people engaged in the process can see what parts have been done, what parts are currently being assembled with specific dates. They also include pictures, drawings, and any other data related to each prefabricated part in the Trello platform to have complete info on each part. The board further serves as institutional memory with past examples of prefab requests, examples, and scopes.



Leicht, R. M., Messner, J. I., and Asadian, E. (2021). A case study in lean construction: Rosendin Electric. Case Study No. 01, Architectural Engineering, The Pennsylvania State University, Univ. Park, PA.

9







**Shop Facility** 



Office



Personnel Interviews



Capture Short Videos



# Lean Methods for Trade Partners



## Organizing & Prioritizing Lean Methods

Frade + GC

Reliable Coordination

Lean
Project
Production

Lonely Lean Production

Reliable Production

**Multiple Trades** 

Integrated Lean Methods



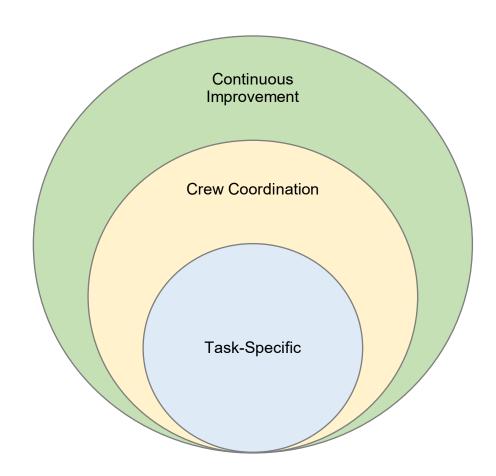
Coordinated Lean Methods

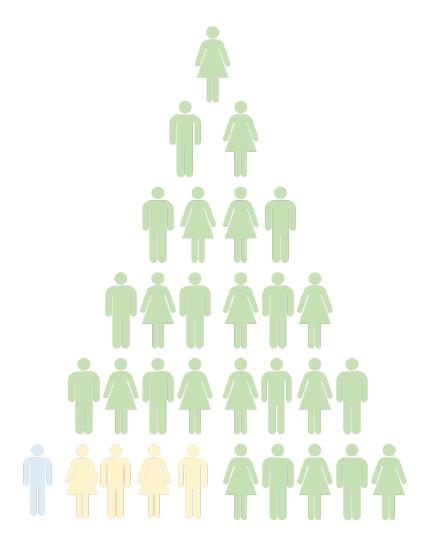


**Fundamental Lean Methods** 

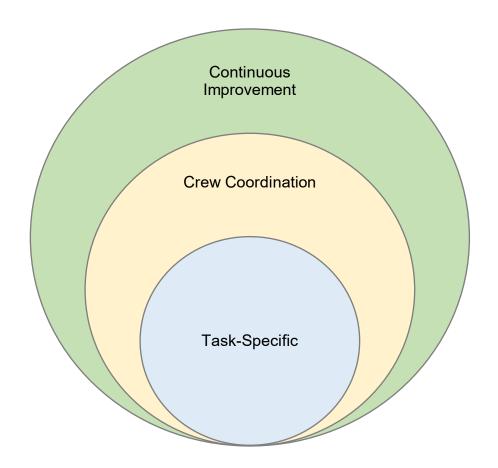


# Identifying your Lean Methods by your Sphere of Influence





## Identifying your Lean Methods by your Sphere of Influence





### Taskspecific

#### 8 Wastes

A simple method to introduce the idea of recognizing waste effort and resources that detract from producing value in work that is performed.

#### Standard Work

Creating consistent processes and techniques for how work is performed based upon best practices.

#### **5S**

An approach for workplace organization and maintaining visual control. The "S" stands for: Sort. Set-in-order, Standardize, Shine, and Sustain.

#### **Kitting**

Sorting, grouping and packaging separate but related items together to reduce packaging and waste at the workface.



### Crew **●** Coordination

#### **Weekly Work Plans**

Method within the Last Planner System that supports collaborative and commitment-based planning and control that helps develop a reliable workflow.

#### **Daily Huddle**

A structured daily check-in for briefly highlight key plans, emerging constraints or safety concerns, changes, and team accomplishments.

#### **Visual Management**

A way to manage information visually such that it enables collaboration, open communication, helps track progress and notice disruptions quickly.

#### Prefabrication

Strategies employed in production to develop assemblies or components off-site to streamline work on- site.

### **Continuous** ✓ Improvement

#### A3 Thinking

Documentation approach for problem- solving and reporting on project-related critical decisions using the Plan - Do - Check - Adjust. (PDCA) method for continuous improvement.

#### Value Stream Mapping

Mapping the process by including value and nonvalue add work activities to identify areas of improvement in the delivery process.

#### Gemba Walk

Means "Going to the work" or walking the job site where the actual work is done to identify waste elimination opportunities.

#### 5 Whys

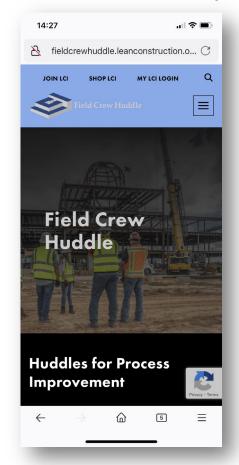
Problem solving technique to determine root cause by diving deeper into the "why" five times.



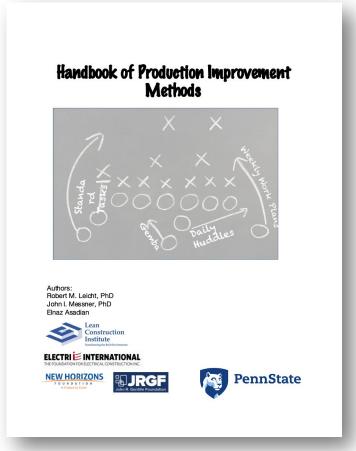


## Accessing the methods and resources

https://fieldcrewhuddle.leanconstruction.org/







**Mobile-friendly website** 

**Downloadable Handbook** 

### Field Crew Huddle – Methods

#### Daily Huddle

The Daily Huddle is a structured neeting with the main goal of coordinating tasks or changing nformation for the project team on the near-term plan. The meeting is usually brief, nformal, but frequent – often daily. This technique is used for communicating and for the project team's everyday meeting process to accomplish workers' involvement.



The daily huddle is a short. daily meeting to convey information updates, confirm or coordinate daily tasks, and to identify and resolve issues.

Due to the short target durations, meetings are often held as 'stand-up' meetings to ensure quick updates. Key information such as safety concerns, important deliveries, or lastminute changes can be quickly shared with the



deliveries, inventories etc.

· Last Planner System (LPS)

· Visual Management

Complementary Methods

### **Best Practices**

- Use a dedicated facilitator for an effective and proquetive
- · Focus on the How, not the Why. Try to produce solutionsbased discussions instead of status-based presentations
- Engage everyone who attends.

- eep it short and solutionriented
- Stick to the agenda. Start on time and end on time.
- Ask questions as a way that will encourage your employees to be proactive.
- Make sure participants aren't interrupting each other.



- · Forget that the details matter. · Use it as a venue to scold
- Try to use daily huddles for problem-solving, which requires discussion and a thorough review of all options.



· Book: Beyond the Morning Huddle: HR Management for a Successful Dental Practice, by Dr. Ann Marie Gorczyca

#### Dusines Drivers

- Improve the performance and engagement of employees.
- Improve intern ommunication among team members to address issues on a regular basis.

### Benefits

- Keeps the team connected and maintains healthy team dynamics.
- Streamlined communication makes messages be easily understood.
- Provide an open exchange of thoughts
- Reduced interruptions and rework.



Resources

**Explanation** 

**Application** 

**Process** 

Do / Don't

Drivers &

**Benefits** 

#### **Weekly Work Planning**

nclude only quality assignments (those that are well defined, sound, in the



#### **Application**

sed on the mechanism of Last Planner System® (LPS®), which aims to transform what should be done into what can be done, thus form entory of ready work. The WWP meeting covers weekly plans, safety, quality issues, resources, construction methods and any problems that occur in the field. cation to share information on the project efficiently and accurately

#### Weekly Work Plan Overview

#### **Best Practices**

- on the promises of specific individuals · Connect and visualize the big picture
- Plan a time and track time spent on each task
- Use color-coding to aid visualization

#### Process

The WWP process starts with listing big-picture goals. Afterwards, decide what is needed to meet those goals

Overview of jobs/tasks that have been completed in the past week.

#### Do

- day for this you can review your weekly accomplishments and plan
- Stick to the plan. Reschedule the tasks that weren't completer

#### Don't

- . Forget to include buffers (build in time for the unexpected

#### **Business Drivers**

Last Planner System (LPS)

Root Cause Analysis

Complementary Methods

- **Benefits**
- Prioritize work more effectively through
- Build a commitment to the program and reduce
- . Enable teams to test options to improve

### Ease of Use

- Training |
- workflow, buildability, and program reduc

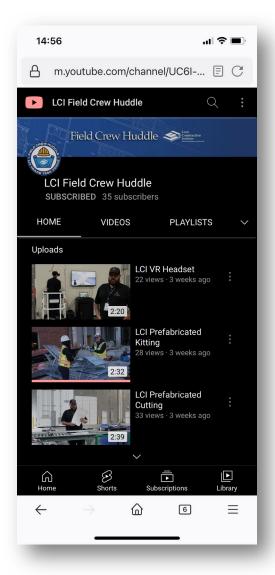
#### Resources

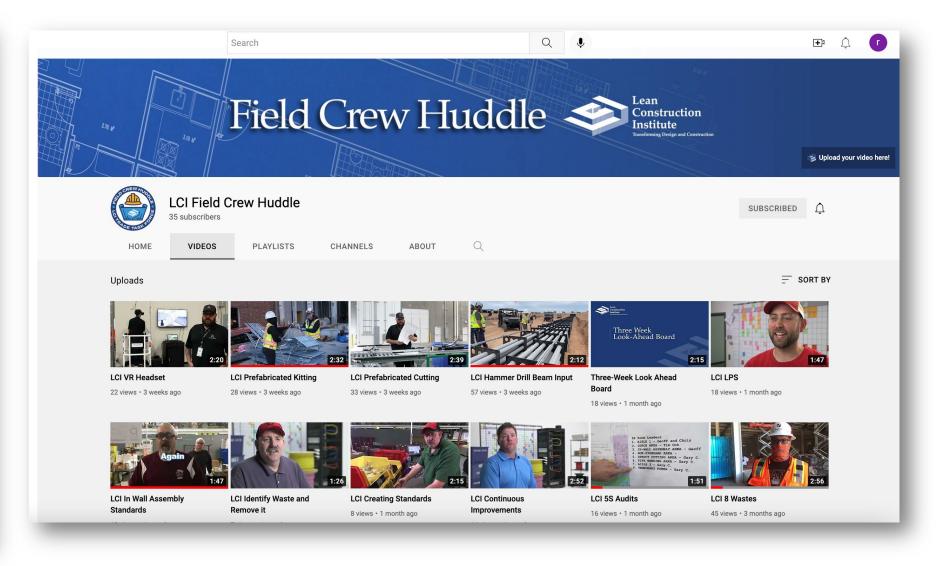
- Book: Lean Deployment Planning Guide (LCI)
- Book: Transforming Design and Construction: Chapter on Last Planne System of Production Control





### Field Crew Huddle – YouTube Videos



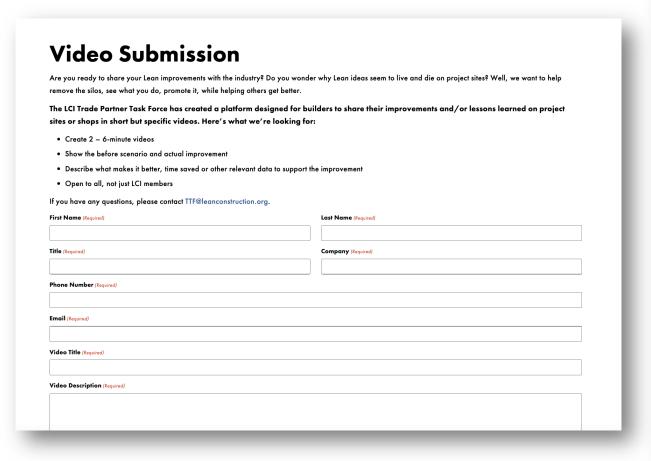


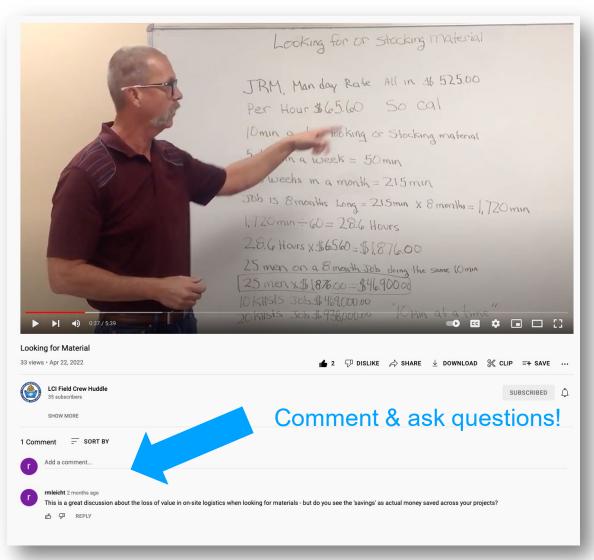




## Field Crew Huddle – Participate!

### Submit your videos!





## Field Crew Huddle – Industry Leader Case Studies

### **How Crew Coordination Improves Outcomes at** KHS&S Contractors

DOWNLOAD CASE STUDY

#### **Background**

KHS&S Contractors – an international design-assist specialty building company – uses a standard process for coordinating the work across crews. The focus of trade work occurs in weekly cycles, breaking large milestones down to manageable scopes of work to hand out to crews or individual workers. Balancing and leveling this work, along with the necessary equipment, tools, and materials, requires detailed weekly work plans to define all of these activities and match them to the project plan and budget.

#### **Weekly Work Plans (WWP)**

Beyond the training and understanding of all elements, KHS&S takes the weekly work plan as a key element for engagement with field personnel. The planning builds from standard Last Planner System (LPS) activities. Still, it is used to align budget information to field activities, plan detailed crew and location assignments, and map work areas and material deliveries.





The tasks for each crew member are laid out for the week. This includes the areas of work and day, using color coding as a visual management strategy. The tasks are broken down to match the budget, so the tracked hours are easily linked back to progress, productivity, and billing. Color-coding the daily tasks within the weekly work plan creates a quick visual link between the crew, task, area, and materials across the different visuals used to plan and coordinate work. Each morning, the plan is discussed as part of each crew's daily huddle.

#### **Daily Huddles**

Daily huddles are conducted each morning before work begins to track the progress and activity of each crew. Using a standard work agenda, the group spends time discussing each crew's production goal, identifying any current of





the simple change they made to how the job box doors open; in an earlier version, a worker needed to stop his coworker to access items below, but could not open the door. However, by simply changing the order of closing, there is no longer a need to stop ongoing activities to access equipment or tools in the lower portion of the job box. This empowerment of workers and willingness to continue to iterate and improve was seen extensively throughout the c



#### **Balancing intention with training**

The core to KHS&S' success appears to stem leadership, in lean principles and a shortlist of projects. The training is defined into three le fundamental training that is targeted for all emp Plan (CIP) an employee engages in when startin tasks, and mastery items each employee mu-Approximately half of these items are addres several further are assessed through their demo such as consistency in leading stand-up meet completing their certification are performed th that is to be presented back to the lean trainers

The training for the bronze, in class, consists of s that are focused on application and reflection, a training is not limited to their in-house personne on what they have found in years of their lean broadly expanding the use of lean for the benef

Leicht, R. M., Messner, J. I., and Asadian, E. (202 Case Study No. 02, Architectural Engineering, TI



**ARCHITECTURAL ENGINEERING** 

### A Case Study in Lean Construction: KHS&S

Robert M. Leicht John I. Messner Elnaz Asadian

Sponsored by Lean Construction Institute, ELECTRI International, New Horizons Foundation, and John R. Gentile Foundation

> Case Study No. 03 October 2021

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The Pennsylvania State University Architectural Engineering University Park, PA 16802





**ARCHITECTURAL** 

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## **Industry Leader Examples**











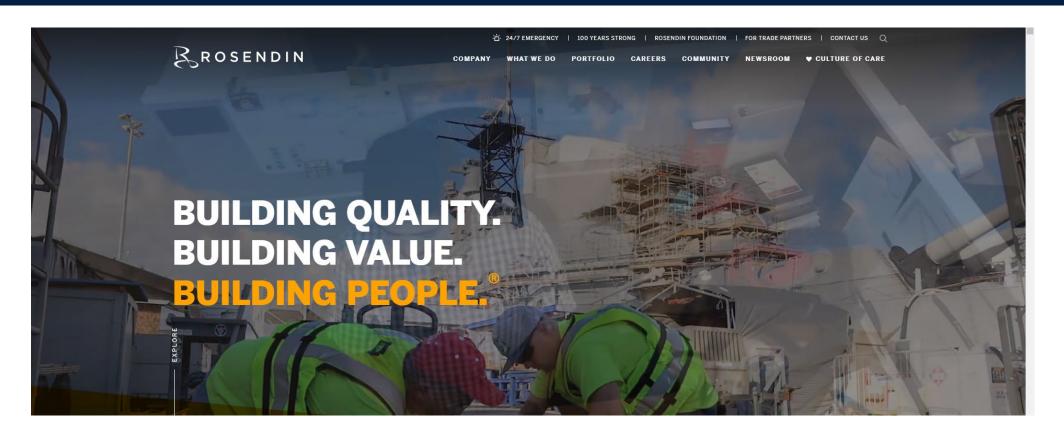




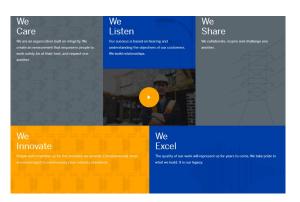




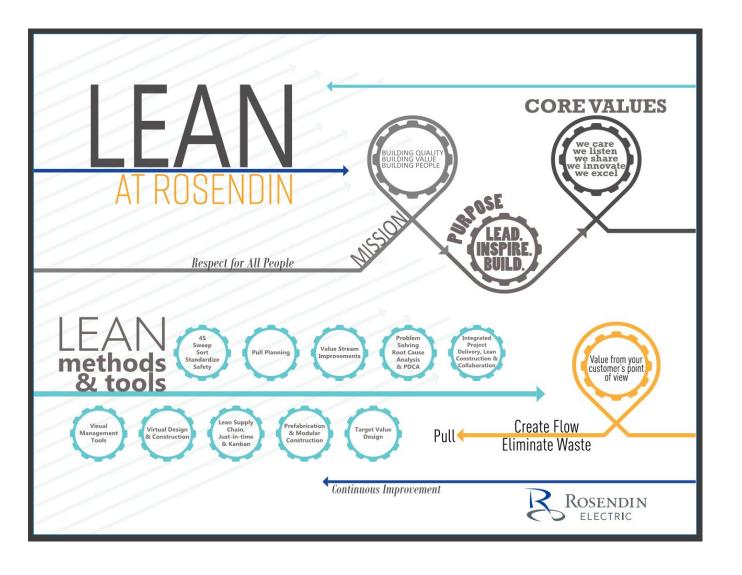












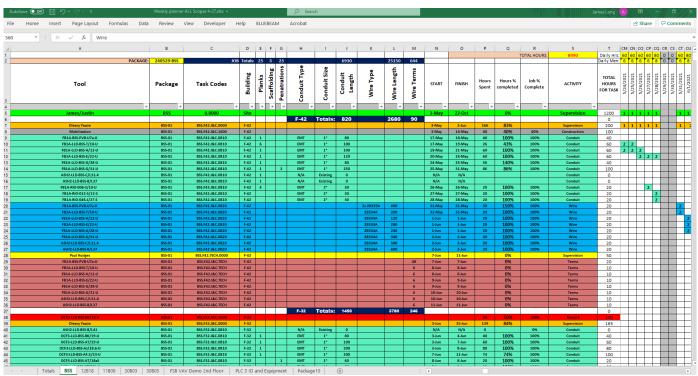
### Lean at Rosendin

- Alignment with Core Values
- Respect for people
- Continuous improvement



## Weekly work planning – **PLAN** your work!

- Empower foremen and crew leads
- Plan labor and tasks in detail at the daily / weekly levels
- Identify:
  - Work / crew locations
  - Material needs & placement
  - Resource needs & constraints



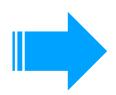






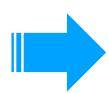
# 5S – Organize resources to enable craft to be efficient













# Standard work – make tasks consistent to get reliable production





# Kits – group components and materials for easy handling





# Standard work – make project planning / documentation standard

									3	WEE	K P	LAN											
Date: 02/13/2			Project Manager:											Chip Block									
Job Name: Best C			Project Manager:  Propared By:									: Schaefer											
Job Number:65	4321		Purchasing Agent: Spunky Brewster Superintendent:															Stu Pedeso					
	Date	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18	1/19	1/20	1/21	1/22	Resources Needed On The Job: Tools, Equipment,
Description of Work	Name(s)		т	w	тн	F	Sat.	Sun.	м	т	w	тн	F	Sat.	Sun.	м	Т	w	тн	F	Sat.	Sun.	Material, Notes
Wall rough room 212			2 -																				Prepackaged A
Wall rough room 214		2 -	2 -	2 -																			Prepackaged B
Wall rough room 216				2 -	2 -	2 -																	Prepackaged A
Wall rough room 218					2 -	2 -			2 -														Prepackaged B
Wall rough room 220									2 •	2 -	2 -												Prepackaged A
Wall rough room 222										2 -	2 -	2 •											Prepackaged C
Roof Penetrations and racks													4 -			4 -	4 -	4 -					Core Driller. Deck Flanges
Level 3 seismic																			4 -	4 -	,		ISAT kits XZ
	Totals	4	4	4	4	4	0	0	4	4	4	2	4	0	0	4	4	4	4	4	0	0	
Alternate Work Available:																							
Site Tem Power removal																							32 man hours. Complete before March 30
Prepackage systems D,E,F																							22 systems to build
NOTES: 1) N	eed approval	for Le	evel 3	wall ro	ough o	chang	es AS	118.															
21 Ve	erify Roof Flai	nges	are ra	ted																			-
_																							-
																							-
_																							-
																							8/13/2019

# Training to improve workforce and communication







# Resources and Path Forward



# Insights & Takeaways

- Fundamentals: Plan your work, organize your tools / materials
- Discipline: training and ongoing emphasis to embed lean thinking into routines and habits
- Start small: Focus on where crews lose time -> moving materials, collecting tools, finding equipment – a few minutes per day add up!
- Empower Craft: More improvements from empowering the workforce, than waiting for the boss to see a problem and fix it
- Risk (cost) is in the field: Everyone should be focused on helping craft focus on their tasks
- Incentives vs penalties: acknowledgement goes a long way!

### Field Crew Huddle website

Prefabricated Kitting



### In-wall Assembly Standards



### Waste – Site Inventory

- Overproduce
- ▶Overdelivery
- Lack of Accountability
- Lack of Coordination
- ▶ Territoriality
- ▶Slows Production
- Creates Safety Hazards



How to find field crew huddle...

### Field Crew Huddle

https://fieldcrewhuddle.leanconstruction.org/





### **A Collaborative Platform**

This site serves as a platform for sharing methods, improvements and lessons learned on project sites or shops through simple visual content and short videos. It houses step-by-step guidance to use methods, and video examples from your colleagues, to allow you to start improving today. To support your work, the content on this site focuses on practical methods and easy-to-follow steps that will let you dive right in. The site format and YouTube videos are intended to provide access to the resources and information in the field — just when and where you need it!

**Greg Stedman** 

Henry Nutt, III

**Nick Masci Tony Lowe** 

**LCI TRADE** Rob Leicht TASK FORCE **Perry Thompson Matt Kittzmiller** 

**Blake Tormey** 

Joe Donarumo

**Elnaz Asadian** 







A Chance to Grow



**Stephanie Roldan** 

**INDUSTRY** 

**Cary Norberg** 

**ADVISORY** Henry Nutt, III GROUP

**Sean Mcguire** 

**Sean Graystone** Thomas Soles, Jr.

> **Brian Winningham Greg Stedman**

> > H. Glenn Ballard

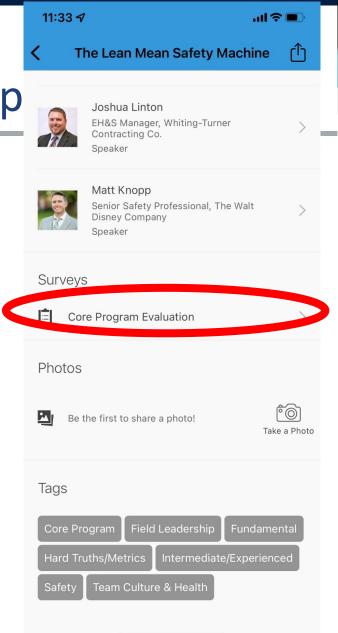


# Rate Presentations in the App

**Continuous improvement:** give presenters your feedback by taking the session evaluation!

- 1. Find the session under "schedule"
- 2. Click on it then scroll down
- 3. Click "core program evaluation"
- 4. Complete the 5-question evaluation

This information will determine the top 5 presentation teams and the top Live Lab





Overall, how valuable was this presentation to you?

Please select an answer:

1 - Not at all
2 - Slightly
3 - Moderately
4 - Very
5 - Highly

Next >







In the spirit of continuous improvement, we would like to remind you to complete this session's survey! We look forward to receiving your feedback.





Thank you for attending this presentation. Enjoy the rest of the 24<sup>th</sup> Annual LCI Congress!

