Lean to the Checkered Flag, with Trades Leading the Pack

Presenters:

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Rosendin Electric

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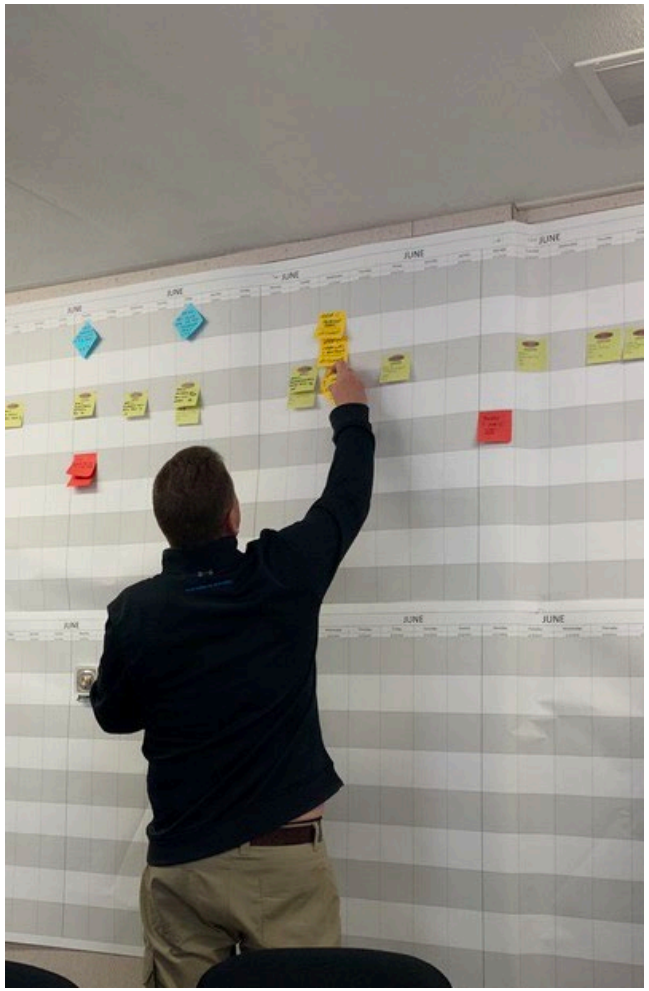
Lean Construction Institute
Transforming Design and Construction

ELECTRI INTERNATIONAL
THE FOUNDATION FOR ELECTRICAL CONSTRUCTION INC.

NEW HORIZONS
FOUNDATION
A Chance to Grow

JRGF
John R. Gentille Foundation

October 25, 2023

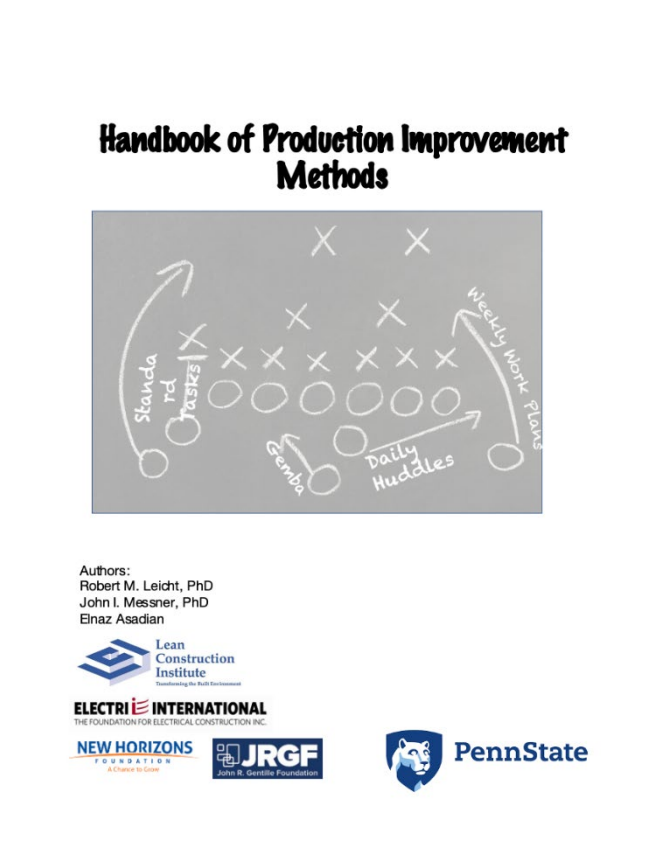


Our goals for today:

- Share the Good to Great examples of trade contractor lean adoption
- Introduce the Field Crew Huddle website and resources
- Share insights and experience from industry experts on their journey

Project - Resources

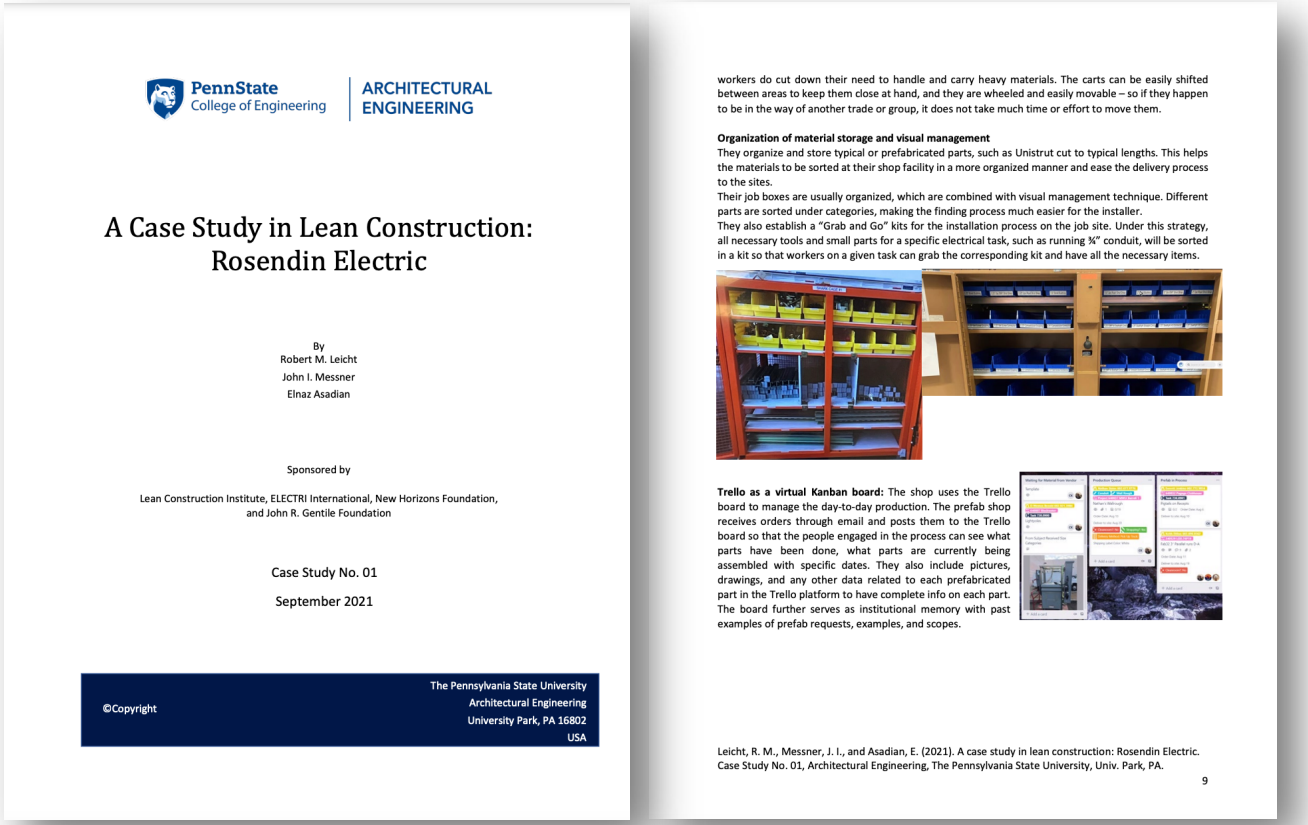
https://fieldcrewhuddle.leanconstruction.org/



Handbook of Production Improvement Methods

Case Studies

Case Studies – Industry Leaders



PennState College of Engineering | 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

The Pennsylvania State University
Architectural Engineering
University Park, PA 16802
USA

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, all necessary tools and small parts for a specific electrical task, such as running ¾" 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.

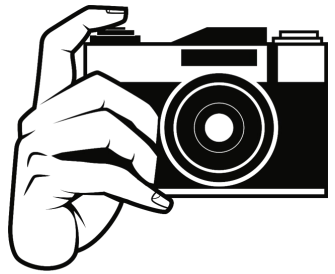
9

Job Site(s)

Office

Shop Facility

Personnel Interviews



Capture Short Videos

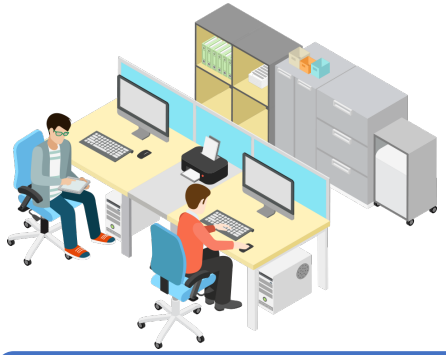
Research Process - Case Study Data Collection

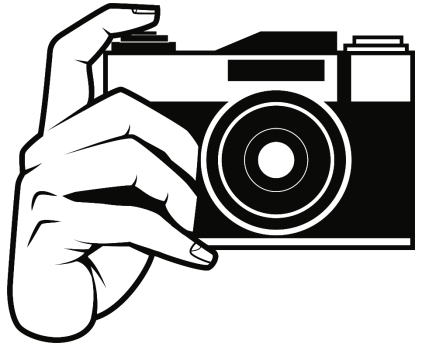
Description	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7
Specialty	Framing & drywall	Electrical	Concrete	Electrical	Electrical	Electrical	MEP
***Location (State)**	California	Arizona	Wash, DC	Pennsylvania	Iowa	Minnesota	Iowa
# of Observation							
Office	1	2	1	1	1	1	1
Job site	2	2	2	1	3	1	2
Shop Facility or Prefab Facility	1	1	1	1	1	2	3
Interviews Conducted							
Higher Management	1	1	3	5	3	6	7
Lean Director / Coach	2	2	1	0	0	0	1
PM/ Field Leaders	2	2	2	2	3	9	7
Shop Manager/ Foreman	1	1	1	0	1	1	4
Safety Manager	1	0	0	0	0	0	1
IT Manager	1	0	0	0	0	0	0
Financial Manager	1	0	0	1	0	0	0
BIM Experts	0	2	0	1	1	0	3
Project Engineer	0	0	1	0	1	0	3
Total # of Interviews	**9**	**8**	**8**	**9**	**9**	**16**	**26**

* Location of offices visited

Case Study Process

Observation





Office | **Job Site(s)** | **Shop Facility** | **Personnel Interviews**

+

Capture Short Videos

Technical Reports & Comparative Analysis between Case Studies

Foreman's Daily Huddle Website

Deliverable - Case Study Summary

KHS&S

A Case Study in Lean Construction: KHS&S

Case Study #02

Initial Draft for Comment: September 20, 2021
Comments Received by: September 24, 2021
Final: September 28, 2021

By Robert Leicht, Elnaz Asadian, and John Messner

Summary:

KHS&S has been successful in their deployment of lean through a balance of ongoing, disciplined training in lean fundamentals and core methods for field operations, with the development of a lean culture that not only empowers, but encourages all employees to strive for improvement and innovation. By defining key lean principles and methods in their Lean House and designing a training curriculum correlated to each of these concepts, they provide a platform to spread their lean culture to the entire organization. Under this mindset, their lean core values, including communication and collaboration, respect for people, continuous improvement, and leadership, are embedded in all their divisions and departments, from the field personnel and project management to IT and Payroll.

They employ a thoughtful array of lean methods in their organization by combining them into daily routines and ongoing training. They have embedded several practical concepts, such as material mapping and color-coded weekly work plans, into daily huddle routines to empower employees to look for waste in their activities. This results in transparent procedures for their tasks, better communication of the plans, and empowerment of the workforce. Numerous examples of these techniques were observed in their office, job site, and production shop facility. They do not limit lean methods and concepts to their construction processes; rather, the training and lean concepts are merged with the daily activities of various departments, such as IT.

In addition to these strategies, KHS&S is seeking innovative methods to extend the use of lean outside of job site constraints through efforts such as prefabrication and modularization. By adopting creative solutions, they continuously seek improvements in their activities, resulting in time and cost savings and a reduction in the workforce.

the simple change they made into how the job boxes 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 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 case study visit and interviews.

KHS&S Lean House

Balancing intention with training

The core to KHS&S' success appears to stem from their ongoing dedication to training, notably field leadership, in lean principles and a shortlist of core methods they deploy on a consistent basis for their projects. The training is defined into three levels, in alignment with their 'Lean House.' The core or fundamental training that is targeted for all employees is their bronze level. The Continuous Improvement Plan (CIP) an employee engages in when starting the training process contains a list of 46 training topics, tasks, and mastery items each employee must complete before receiving their bronze certification. Approximately half of these items are addressed by completing the six-module course training, and several further are assessed through their demonstration that they have mastered the defined methods, such as consistency leading stand-up meetings over a series of observations. The final items for completing their certification are performed through independent reading and research of a lean topic that is to be presented back to the lean trainers or appropriate leadership.

The training for the bronze, in class, consists of six modules, three with primary content delivery and three that are focused on application and reflection, as summarized in Table 1. It is noteworthy to mention that training is not limited to their in-house personnel. KHS&S is willing to share and has extensively presented on what they have found in years of their lean journey with others, demonstrating their commitment to broadly expanding the use of lean for the benefit of the entire construction industry.

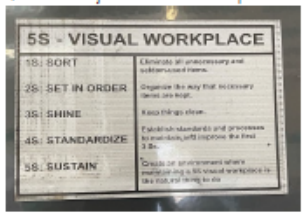
- ***Weekly work plan maps:*** KHS&S' field supervision and crews participate in pull planning sessions, weekly work plans, weekly work plan maps, and progress maps with the General Contractor and affected MEPs to discuss sequencing, milestones, and safety. Even in the absence of GC or trade involvement, they routinely engage their crews in these efforts through their daily huddles.

- **Stand-up boards/meetings:** Daily huddles or stand-up meetings are conducted each morning before work begins to track the progress and activity of each worker or crew. In addition, using a standard work agenda, there is time spent discussing each group's production goal, identifying any current or expected constraints, as well as key safety planning for their activities. Before wrapping up, a 3-minute lean topic is used each day to maintain the emphasis on continuous improvement, and there is a daily stretch and flex, as well as a safety discussion.

- ***Materials maps***

Due to the importance of material inventory control, KHS&S uses material maps to control and track material ordering and logistics. This simple technique helps them track which types of materials have been delivered to the job site and where they will be installed. It also communicates the schedule using color-coding by day and visually portrays to the workforce where materials will be delivered.

- **5 S** – the use of 5s (sort, standardize, set in order, shine, sustain) was consistently applied in the field, shop, and office to organize and streamline the use of materials, tools, and equipment. KHS&S has developed standard, but custom job boxes for their carpenters to improve the ergonomics of field material cutting. It further offered the organization and storage of standard tools. During the observations of a daily stand-up meeting, the foreman gave a brief demonstration with two workers preparing to do their work – one with an organized box and one that was disorganized to demonstrate the impact on time simply to get their tools and standard consumables for starting their daily tasks.



Visual Management – visual management was applied in several ways across operations to support simple, effective communication or tracking. Bundled materials kits at the Production Innovation facility were tagged with colors to make it easy to load only those materials for a given job.

Results & Discussion – Lean Principles used to organize results

Observable Capabilities	Principle (Liker,2004)
Culture and Organizational Values (Company attitude towards production improvement)	Become a learning organization through relentless reflection (hansei) and continuous improvement (kaizen).
Training (Invest in their people)	Develop exceptional people and teams who follow the company's philosophy.
Mentoring and Cultivating Field Leader (Engaging & Empowering)	Grow leaders who thoroughly understand the work, live the philosophy, and teach it to others.
Standardization (Standard Tasks/ Assemblies)	Standardized tasks are the foundation for continuous improvement & employee empowerment.
Process-based Approach (Process Mapping)	Create continuous process flow to bring problems to the surface.
Visual Management	Use visual control, so no problems are hidden.
Access to better tools/equipment/organizing	Use only reliable, thoroughly tested technology that serves people and processes.
Systematic Process (Empowering problem-solving mentality)	Make decisions slowly by consensus, thoroughly considering all options; implement decisions rapidly.

8

Results & Discussion

Implementation Status

Status	Mark	Explanation
Not Observed		Evidence of adoption was not noted or directly observed during the case study.
Partially Implemented		Evidence of the approaches was noted in some interviews or partially observed – suggesting some use but not standard across operations.
Fully Implemented		The approaches were commonly noted in interviews and/or observed as standard elements in company operations.

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Culture and Organizational Values

Common Approaches in Culture and Organizational Values

Approaches	A	B	C	D	E	F	G
Align continuous improvement principles with **organizational values**	●	●	●	●	◡	◡	◡
Adopt continuous improvement approaches in **long-term goals**	●	●	●	●	●	●	◡
Create an **organizational environment** that enables continuous improvement	●	●	●	◡	●	◡	◡
Empowering everyone to pursue continuous improvement	●	◡	◡	●	◡	◡	◡
Develop a **continuous improvement culture** in all divisions/ departments	●	●	●	●	○	◡	○
Consider employees as **internal customers**	●	●	●	◡	◡	○	○

*Note – company order changes for each table to re-order from highest to lowest observed adoption

Image courtesy of Rosendin Electric

- Embedding lean principles with company core values allows methods to be easily grounded in how each firm operates.
- Empowering their employees to engage in the CI process.

Mentoring and Cultivating Field Leaders

Common Approaches in Mentoring and Cultivating Field Leaders

Approaches	A	B	C	D	E	F	G
Empowering people through guidance, standards, and flexibility	●	●	●	●	●	◒	◒
Courses for training **field leaders**	●	●	●	●	●	◒	○
Develop and **promote people** into leadership roles	●	●	●	●	●	◒	◒
Emphasis on both **technical and leadership training**	●	●	●	●	●	●	●
Different mentoring programs to **develop leaders and grow coaches**	●	◒	◒	◒	◒	○	○

*Note – company order changes for each table to re-order from highest to lowest observed adoption

Leadership coming from the field

Images courtesy of KHS&S

- Mentoring- companies' culture, processes, methods and standards
- Promote from within
- Inclusion of craft

Standardization

Common Approaches in Standardization

Approaches	A	B	C	D	E	F	G
The standardization of **work processes**	●	●	●	●	◡	◡	◡
Reduce variation whenever possible	●	●	●	●	◡	◡	◡
Track, share, and display key metrics that result from production standards and common work practices	●	●	◡	◡	●	◡	◡
Tactics for standardization embody the **nature of the work**	●	●	●	●	●	●	◡

*Note – company order changes for each table to re-order from highest to lowest observed adoption

Balancing autonomy and standardization

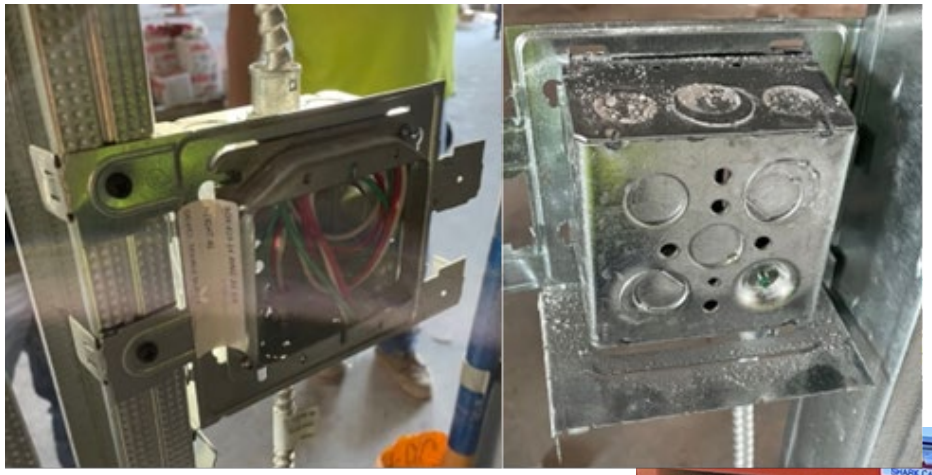


Image courtesy of Thompson Electric

- Use standard to make work easier
- Transparency

Image courtesy of Rosendin Electric

Process-based Approach

Common Approaches in Process-based Approach

Approaches	A	B	C	D	E	F	G
Identify and eliminate waste to support organizational functions	●	●	◡	●	●	◡	○
Define processes for performing their tasks to bring consistency and clarity.	●	●	●	◡	◡	◡	◡
Document current processes and refine them into **best practices**.	●	●	●	◡	◡	◡	◡
Work packaging is **standard across phases** for planning, fabrication, tracking and reporting.	●	●	●	◡	◡	●	◡
Measure how effectively new **processes or approaches** are relative to the baseline.	●	●	◡	◡	◡	◡	◡

*Note – company order changes for each table to re-order from highest to lowest observed adoption

Work Packaging -> Takt time on site

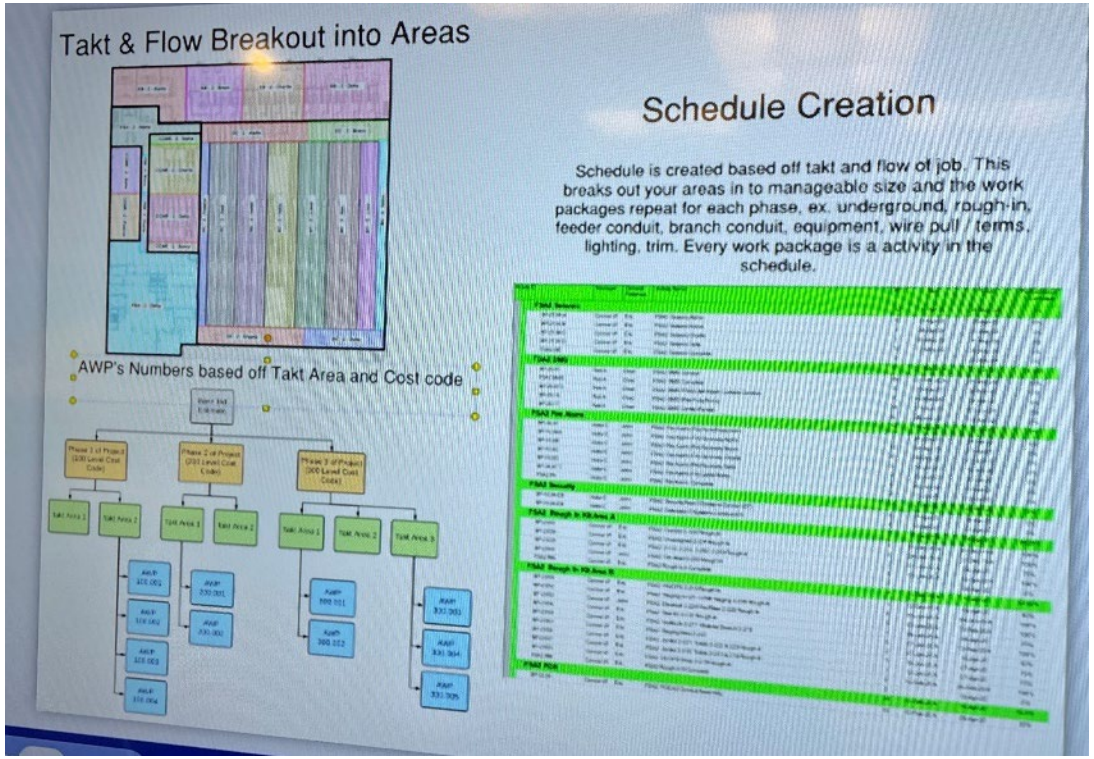


Image courtesy of Parons Electric

Visual Management

Common Approaches in Visual Management

Approaches	A	B	C	D	E	F	G
Apply VM **across operations** to support simple, effective **communication or tracking**.	●	●	●	◡	◡	◡	◡
VM is **built into the inventory management** system and processes.	●	◡	●	●	●	◡	◡
Extensive use of **color-coding**	●	●	◡	◡	◡	◡	◡
Use VM for **information sharing**, such as productivity reports and project standards	◡	●	●	◡	●	◡	◡
Use VM for **communication and raising awareness**	●	●	◡	◡	○	○	○

*Note – company order changes for each table to re-order from highest to lowest observed adoption

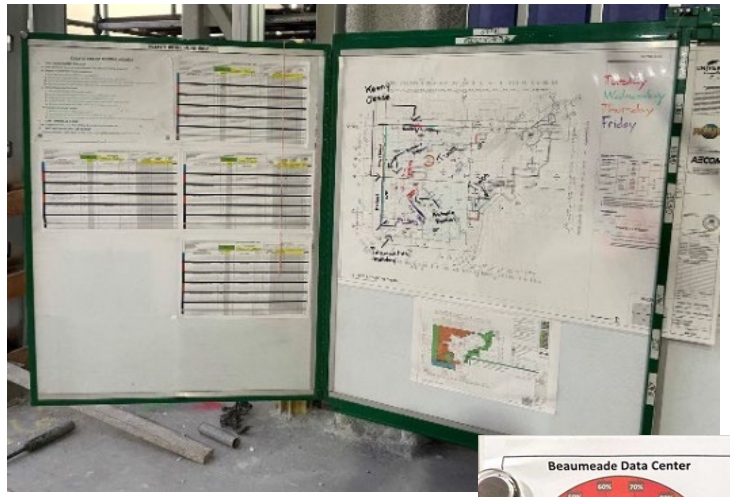


Image courtesy of KHS&S

- Raise awareness
- Information sharing
- Identify problems

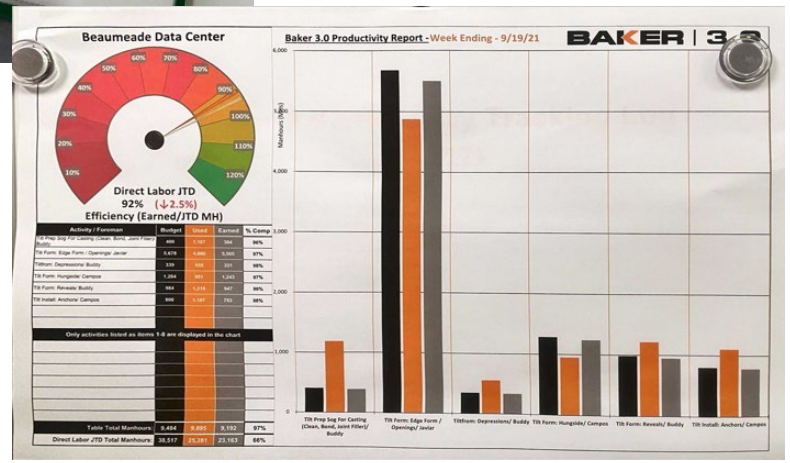


Image courtesy of Baker Concrete

Better tools & equipment

Common Approaches in Access to better tools/equipment

Approaches	A	B	C	D	E	F	G
Unbundling of complex methods to **simple and easily understood** concepts.	●	●	●	◒	○	◒	◒
Use better tools or equipment to **facilitate field operations**	●	●	●	●	●	◒	◒
In parallel with standardization, they **match their tools and equipment with their operations**.	●	●	●	●	●	◒	◒
Allocate a specific budget for providing better tools, which is **separated from the project costs**	◒	◒	◒	◒	○	○	○

*Note – company order changes for each table to re-order from highest to lowest observed adoption

Ultimate Goal: Making the field tasks easier and safer

Image courtesy of Thompson Electric

Image courtesy of KHS&S

- Unbundling
- Better tools

Cultivated problem-solving mentality

Common Approaches in Systematic Processes (Empowering problem-solving mentality)

Approaches	A	B	C	D	E	F	G
Sustaining improvements to processes through **frequent reviews and coaching** to ensure they are being implemented.	●	●	◒	●	◒	◒	◒
Gathering **input from all company stakeholders** to agree upon or refine processes and methods	●	●	●	◒	◒	○	○
Focus on **small improvements and appreciate new ideas** for improvement from the workforce	●	◒	●	◒	◒	○	○

*Note – company order changes for each table to re-order from highest to lowest observed adoption

"Fix what bugs you"

Image courtesy of Parsons Electric

Good to Great

Focus on Continuous Improvement - Empowering people toward CI through the alignment of values, goals, and methods

Focus on People - Training extended into mentoring and coaching

Focus on process - using standards and visual communication to make work easier

A Case Study in Lean Construction: Southland Industries

Capabilities

We provide full lifecycle solutions through one point of contact for design, build, and maintenance.

Engineering

Construction

Service

Energy

Fire Protection

Locations

Mid-Atlantic
- Dulles, VA
- Laurel, MD

Mountain West
- Las Vegas, NV
- Phoenix, AZ
- Tempe, AZ

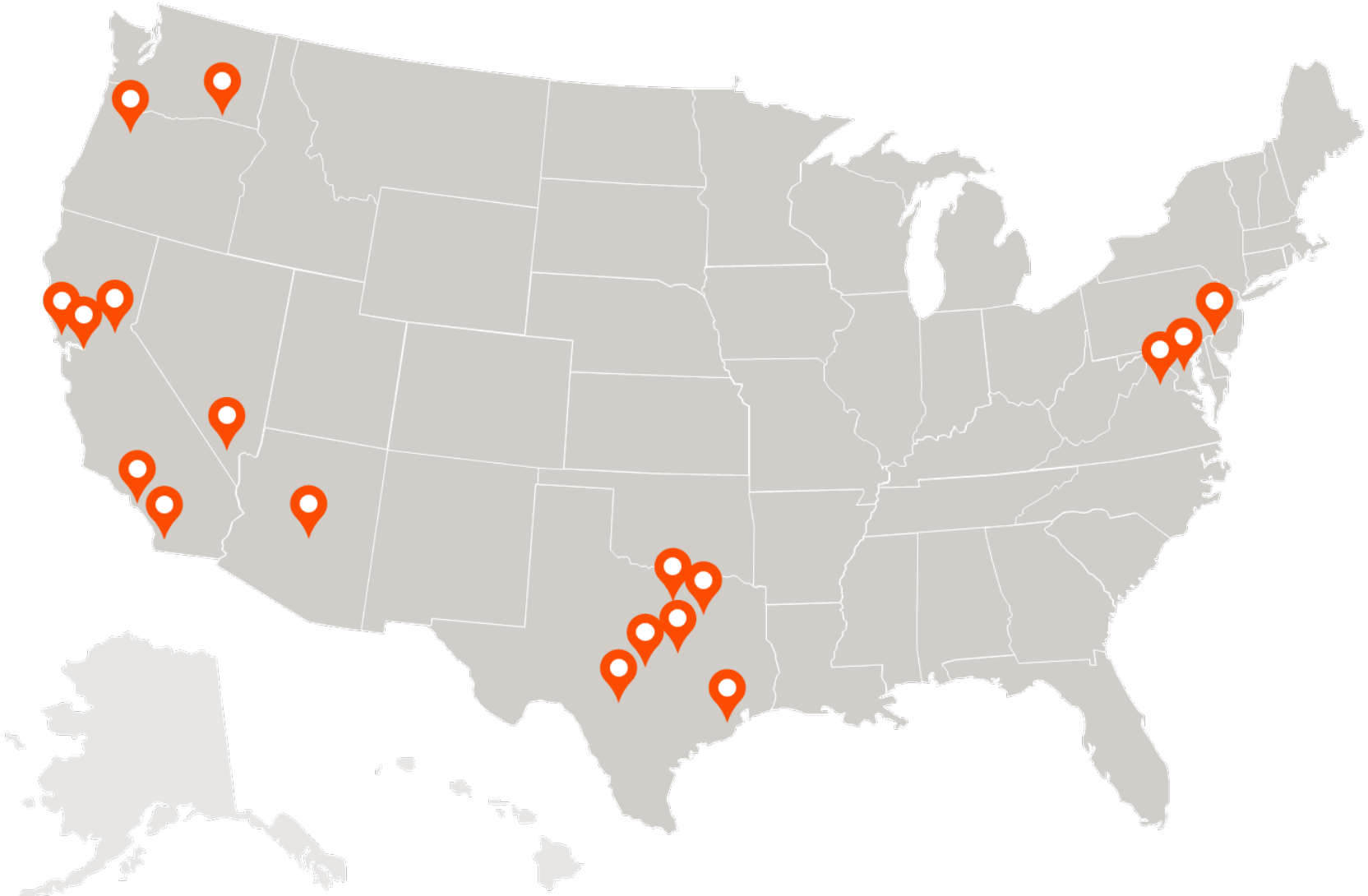
Northern California
- Sacramento, CA
- Union City, CA
- Walnut Creek, CA

Northwest
- Portland, OR
- Kennewick, WA

Philadelphia (Burns)
- Horsham, PA
- Conshohocken, PA

Southern California
- Los Angeles, CA
- San Diego, CA

Texas (The Brandt Companies)
- Austin, TX
- Dallas, TX
- Fort Worth, TX
- Houston, TX
- San Antonio, TX
- Waco, TX



UCSF Block 34 Clinical Building in San Francisco, CA

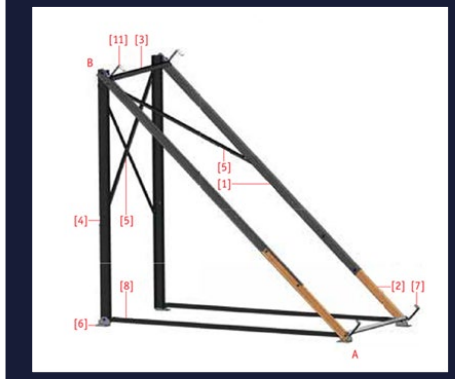
Building Info:

- 181,000 SF
- 5 stories
- OSHPD 3
- HVAC & PL Scopes
- Design-assist
- All electric
- 13 OR rooms
- 6 double stack AHUs with run around coils
- 4 heat recovery chillers
- 30,000 linear feet of ductwork
- 53,000 linear feet of pipe

Donation

Jan

Sketch of support structure



Feb

Mock-ups built/tested in shop

Oct

System installation

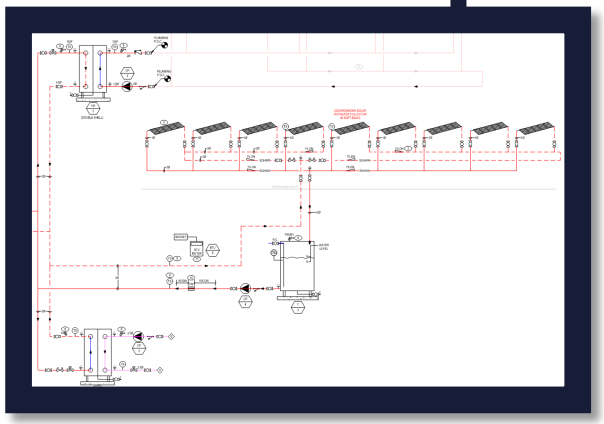
Feb

2021

2022

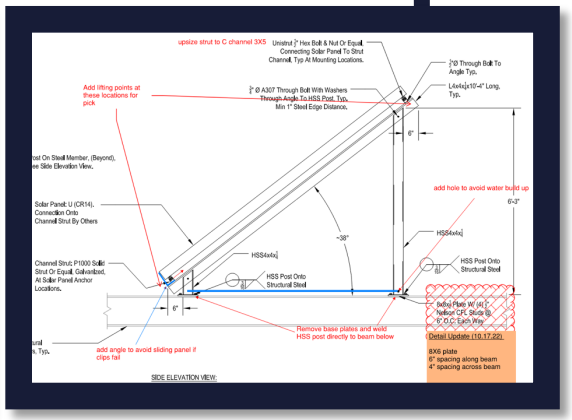
2023

Jun



Schematic System Design

May



Evaluation and mark-ups

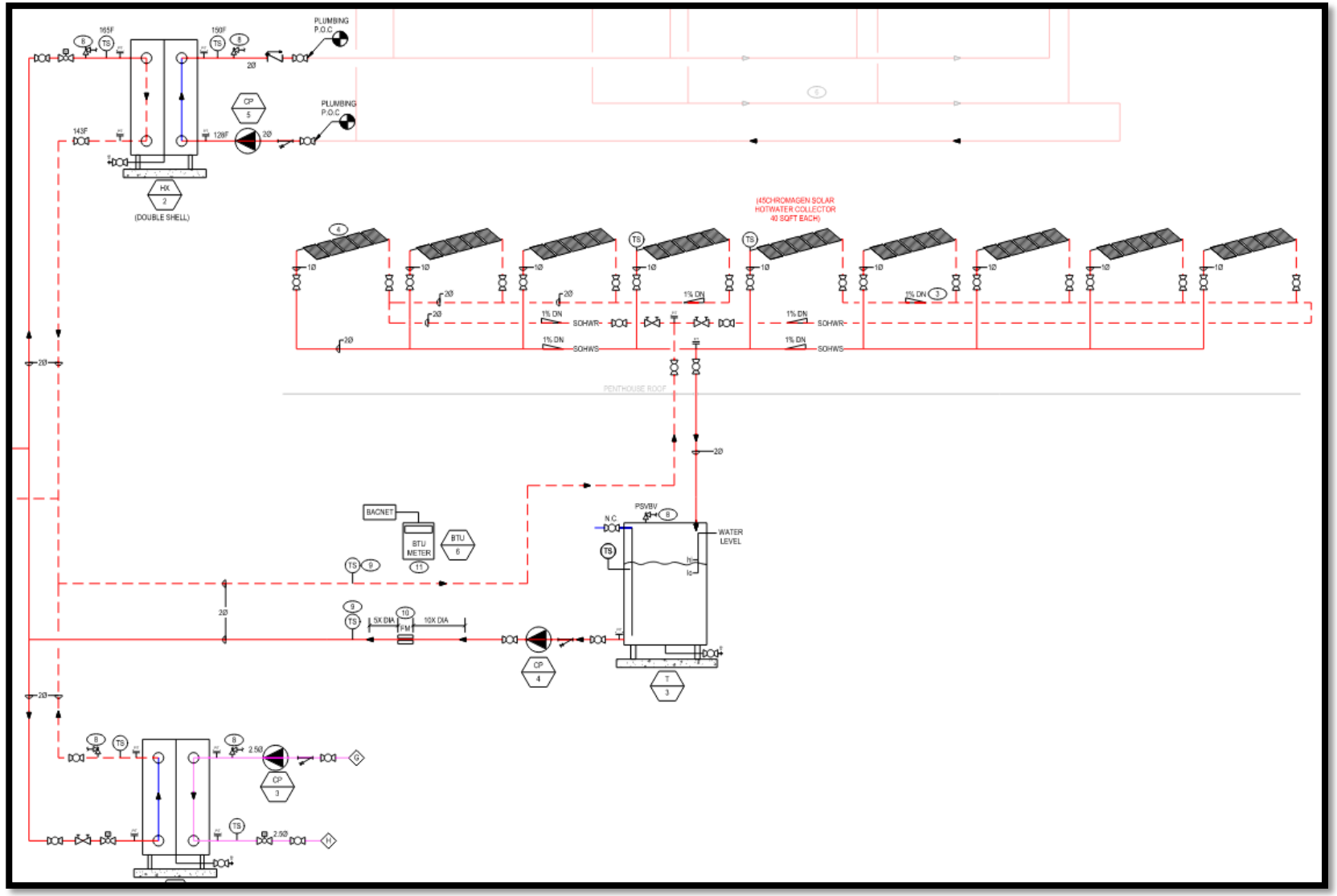
Jan

Shop fabrication and assembly

Jun

Solar array operational

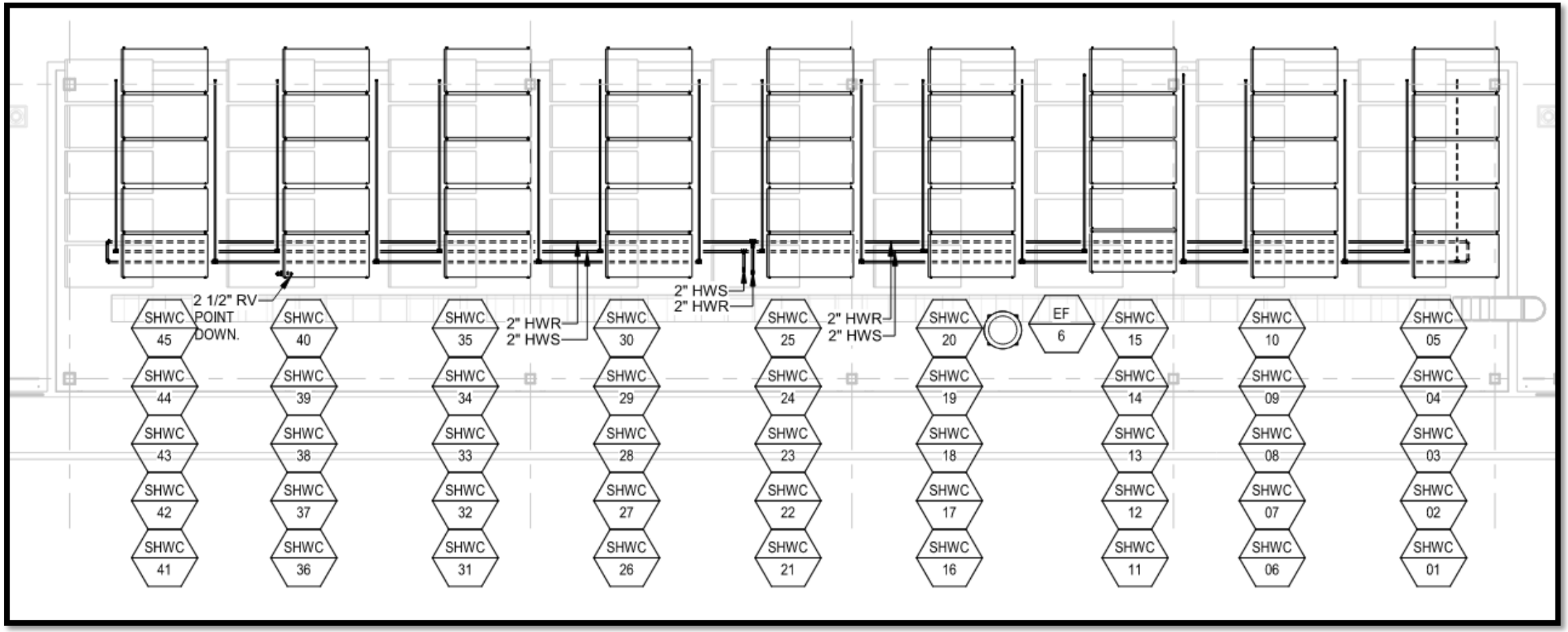
How It Started – Initial Design



- Panels get donated to UCSF
- Design team strategizes on how to use them
- Decided on providing supplemental heating to domestic and hydronic hot water systems.

Schematic Phase

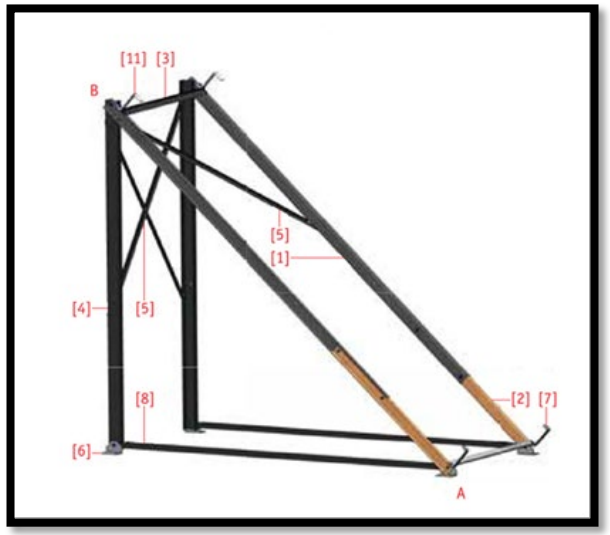
- 45 solar hot water collectors on top of penthouse roof (97' ft above ground level)
- Initial concerns: unsafe location, heavy, specific angle



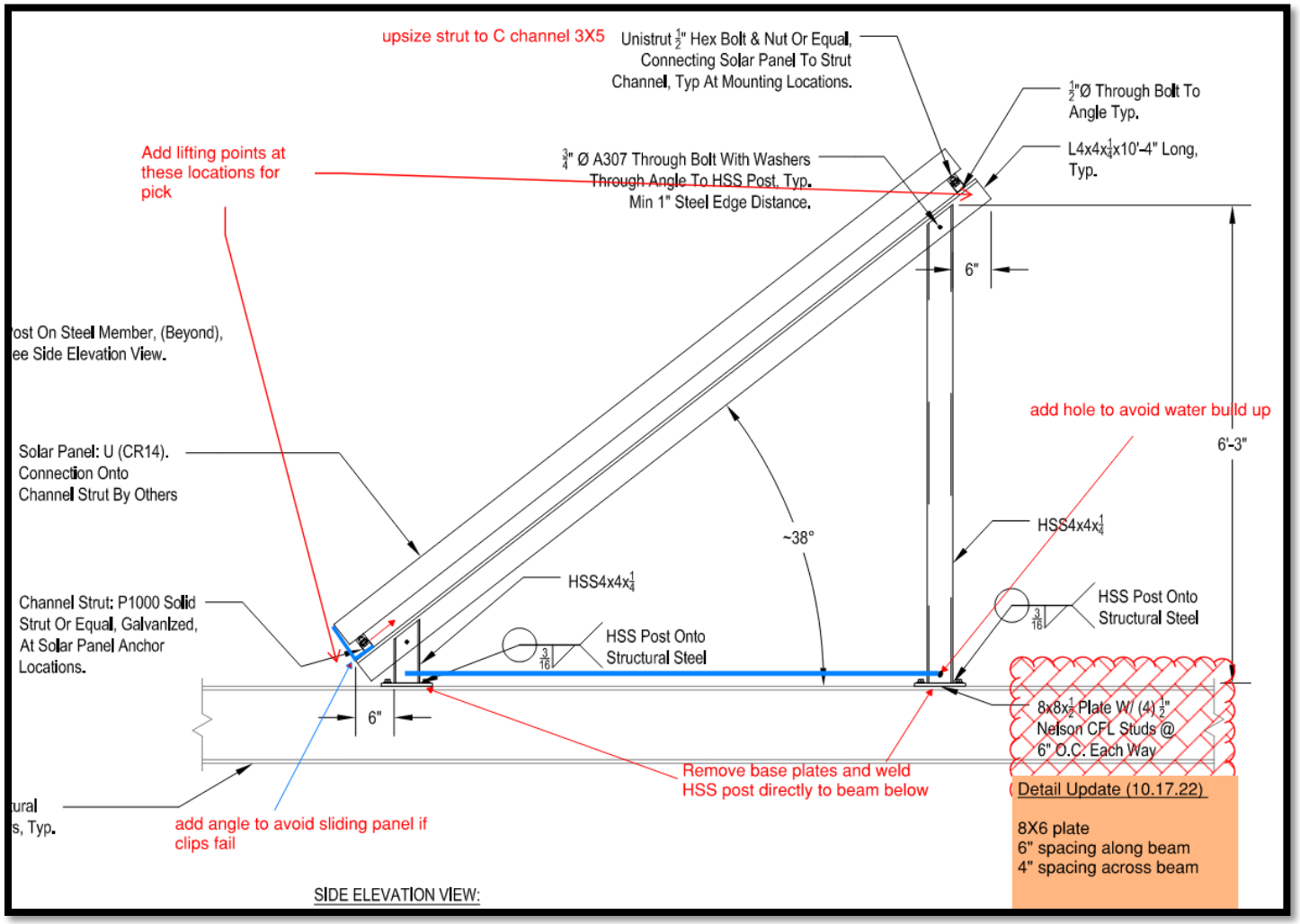
10' Length x 3 ½" Width x 4' Height

130 pounds each

Designing the Support Structure



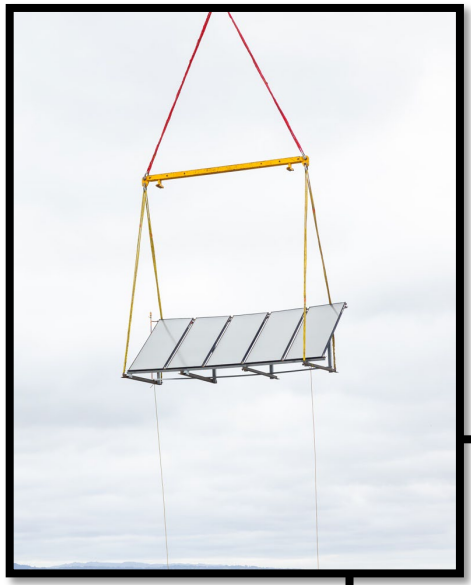
From Manufacturer's Catalog

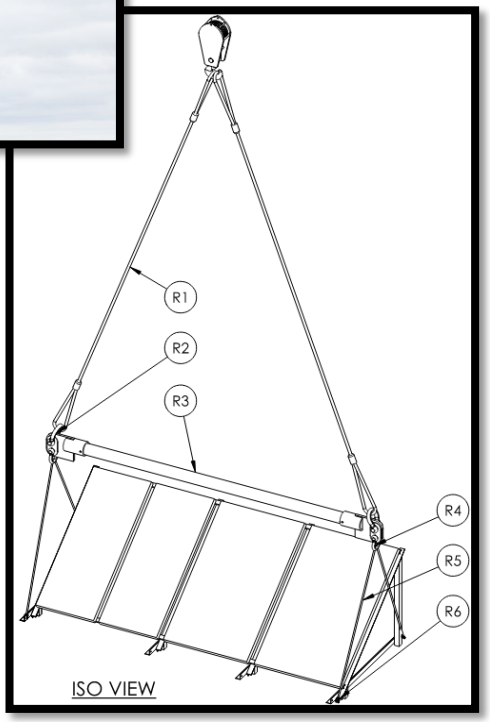


Our Updated Design

Design for Manufacturing and Assembly (DFMA)

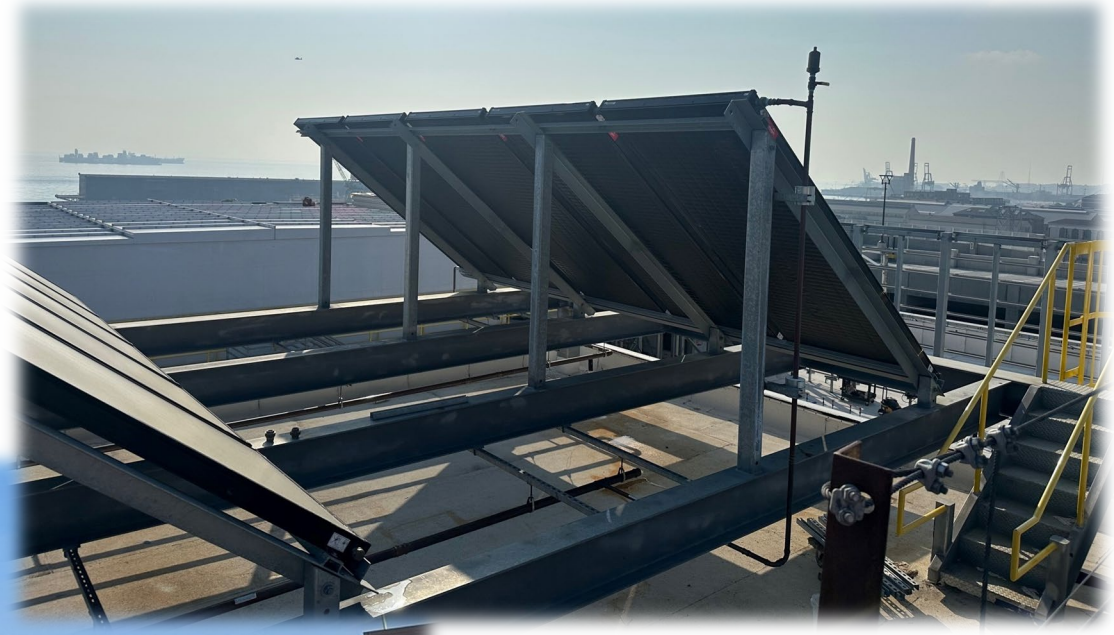
Crane Day

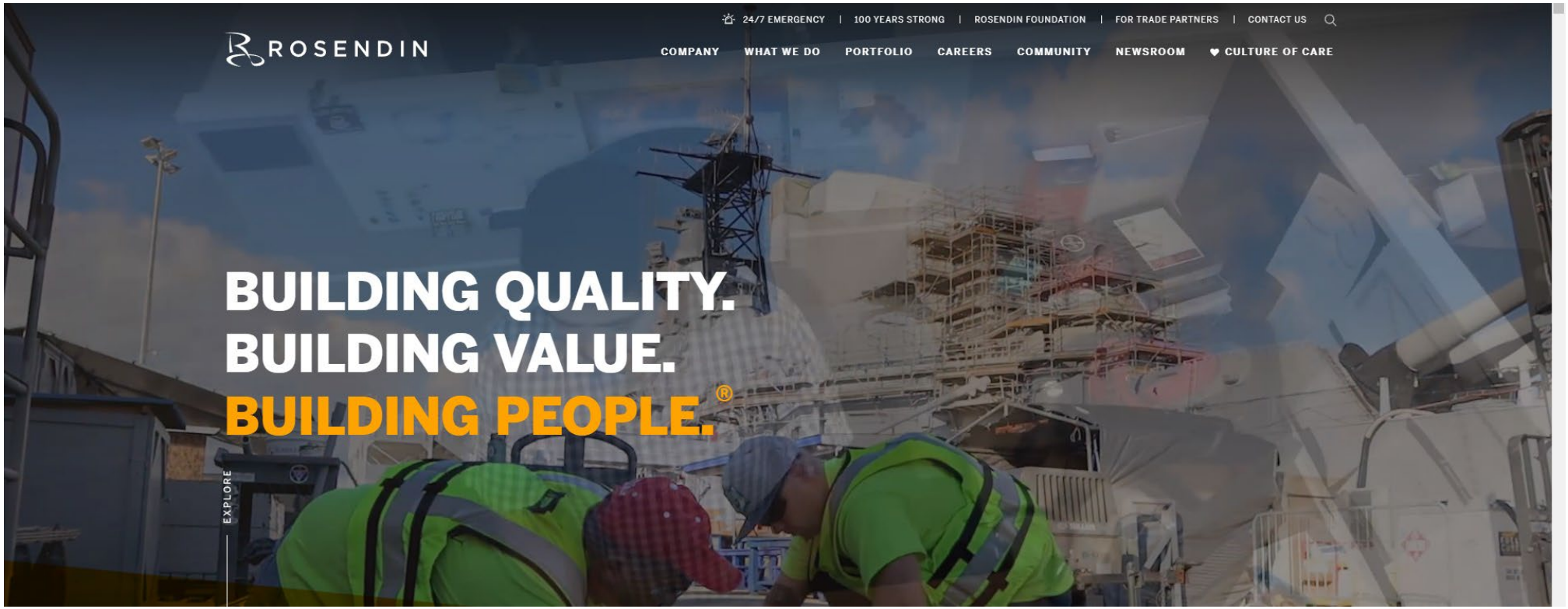


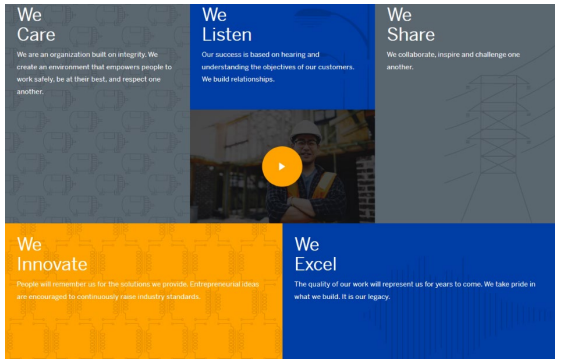


Crane Day - Roof

How It's Going - Lessons Learned







100 ROSENDIN

Lean Construction Institute
Transforming the Built Environment

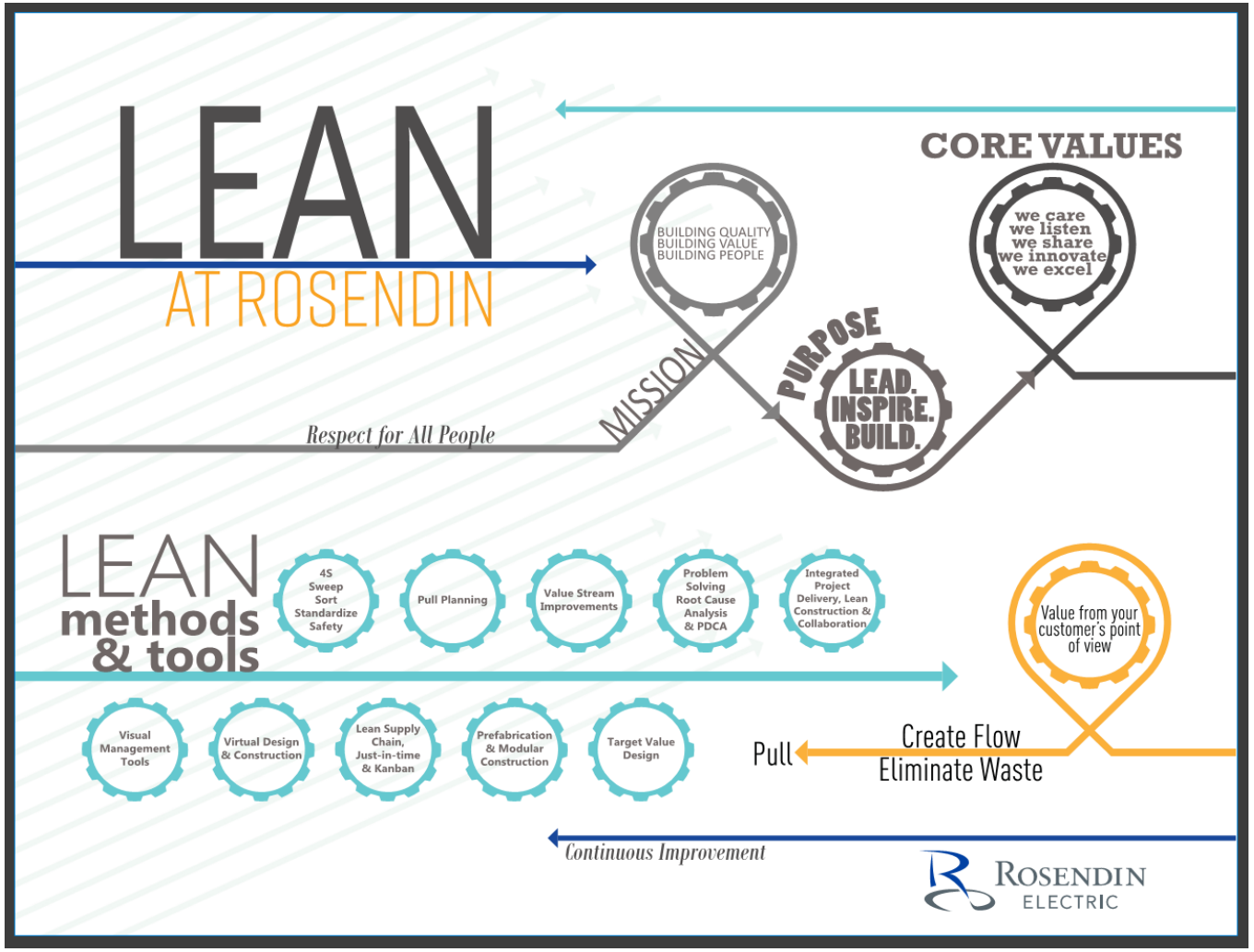
ELECTRI INTERNATIONAL
THE FOUNDATION FOR ELECTRICAL CONSTRUCTION INC.

NEW HORIZONS
FOUNDATION
A Chance to Grow

JRGF
John R. Gentille Foundation

PennState
College of Engineering

ARCHITECTURAL ENGINEERING

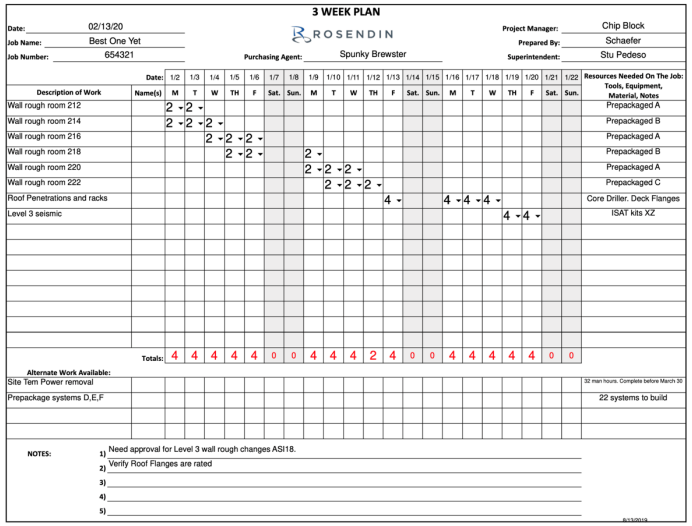


Lean at Rosendin

- 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



3 WEEK PLAN

Date: 02/13/20 | Project Manager: Chip Block
Job Name: Best One Yet | Prepared By: Schaefer
Job Number: 654321 | Purchasing Agent: Spunky Brewster | Superintendent: Stu Pedeso

ROSENDIN

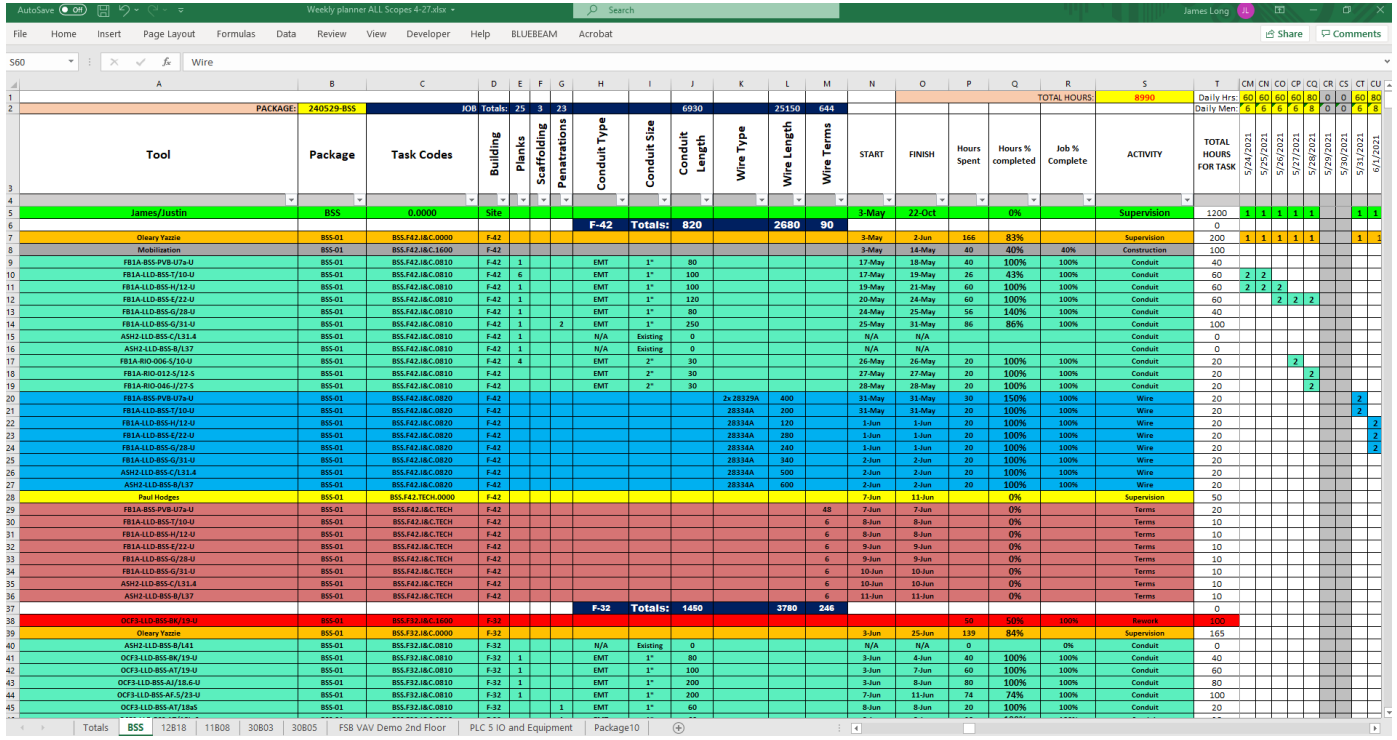
Description of Work	Name(s)	1/2 M	1/3 T	1/4 W	1/5 TH	1/6 F	1/7 Sat.	1/8 Sun.	1/9 M	1/10 T	1/11 W	1/12 TH	1/13 F	1/14 Sat.	1/15 Sun.	1/16 M	1/17 T	1/18 W	1/19 TH	1/20 F	1/21 Sat.	1/22 Sun.	Resources Needed On The Job: Tools, Equipment, Material, Notes
Wall rough room 212		2	2																				Prepackaged 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) Need approval for Level 3 wall rough changes ASI18.
2) Verify Roof Flanges are rated
3)
4)
5)

8/13/2019



Weekly planner ALL Scopes 4-27.xlsx — James Long

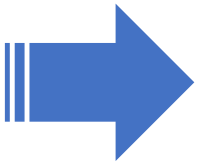
File Home Insert Page Layout Formulas Data Review View Developer Help BLUEBEAM Acrobat — Share — Comments

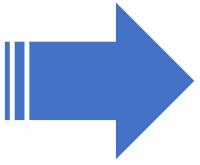
S60 | Wire

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	CM	CN	CO	CP	CQ	CR	CS	CT	CU
1																		TOTAL HOURS:	8990	Daily Hrs:	60	60	60	60	80	0	0	60	80
2	PACKAGE:	240529-BSS	JOB Totals:	25	3	23				6930		25150	644							Daily Men:	6	6	6	6	8	0	0	6	8
3	Tool	Package	Task Codes	Building	Planks	Scaffolding	Penatrations	Conduit Type	Conduit Size	Conduit Length	Wire Type	Wire Length	Wire Terms	START	FINISH	Hours Spent	Hours % completed	Job % Complete	ACTIVITY	TOTAL HOURS FOR TASK	5/24/2021	5/25/2021	5/26/2021	5/27/2021	5/28/2021	5/29/2021	5/30/2021	5/31/2021	6/1/2021
4																													
5	James/Justin	BSS	0.0000	Site										1-May	22-Oct		0%		Supervision	1200	1	1	1	1	1			1	1
6								F-42	Totals:	820		2680	90							0									
7	Oleary Yazzie	BSS-01	BSS.F42.I&C.0000	F-42										3-May	2-Jun	166	83%		Supervision	200	1	1	1	1	1			1	1
8	Mobilization	BSS-01	BSS.F42.I&C.1600	F-42										3-May	14-May	40	40%	40%	Construction	100									
9	FB1A-BSS-PVB-U7a-U	BSS-01	BSS.F42.I&C.0810	F-42	1			EMT	1"	80				17-May	18-May	40	100%	100%	Conduit	40									
10	FB1A-LLD-BSS-T/10-U	BSS-01	BSS.F42.I&C.0810	F-42	6			EMT	1"	100				17-May	19-May	26	43%	100%	Conduit	60	2	2							
11	FB1A-LLD-BSS-H/12-U	BSS-01	BSS.F42.I&C.0810	F-42	1			EMT	1"	100				19-May	21-May	60	100%	100%	Conduit	60	2	2	2						
12	FB1A-LLD-BSS-E/22-U	BSS-01	BSS.F42.I&C.0810	F-42	1			EMT	1"	120				20-May	24-May	60	100%	100%	Conduit	60			2	2	2				
13	FB1A-LLD-BSS-G/28-U	BSS-01	BSS.F42.I&C.0810	F-42	1			EMT	1"	80				24-May	25-May	56	140%	100%	Conduit	40									
14	FB1A-LLD-BSS-G/31-U	BSS-01	BSS.F42.I&C.0810	F-42	1		2	EMT	1"	250				25-May	31-May	86	86%	100%	Conduit	100									
15	ASH2-LLD-BSS-C/L31.4	BSS-01	BSS.F42.I&C.0810	F-42	1			N/A	Existing	0				N/A	N/A				Conduit	0									
16	ASH2-LLD-BSS-B/L37	BSS-01	BSS.F42.I&C.0810	F-42	1			N/A	Existing	0				N/A	N/A				Conduit	0									
17	FB1A-RIO-006-5/10-U	BSS-01	BSS.F42.I&C.0810	F-42	4			EMT	2"	30				26-May	26-May	20	100%	100%	Conduit	20					2				
18	FB1A-RIO-012-5/12-S	BSS-01	BSS.F42.I&C.0810	F-42				EMT	2"	30				27-May	27-May	20	100%	100%	Conduit	20						2			
19	FB1A-RIO-046-J/27-S	BSS-01	BSS.F42.I&C.0810	F-42				EMT	2"	30				28-May	28-May	20	100%	100%	Conduit	20						2			
20	FB1A-BSS-PVB-U7a-U	BSS-01	BSS.F42.I&C.0820	F-42							2x 28329A	400		31-May	31-May	30	150%	100%	Wire	20								2	
21	FB1A-LLD-BSS-T/10-U	BSS-01	BSS.F42.I&C.0820	F-42							28334A	200		31-May	31-May	20	100%	100%	Wire	20								2	
22	FB1A-LLD-BSS-H/12-U	BSS-01	BSS.F42.I&C.0820	F-42							28334A	120		1-Jun	1-Jun	20	100%	100%	Wire	20									2
23	FB1A-LLD-BSS-E/22-U	BSS-01	BSS.F42.I&C.0820	F-42							28334A	280		1-Jun	1-Jun	20	100%	100%	Wire	20									2
24	FB1A-LLD-BSS-G/28-U	BSS-01	BSS.F42.I&C.0820	F-42							28334A	240		1-Jun	1-Jun	20	100%	100%	Wire	20									2
25	FB1A-LLD-BSS-G/31-U	BSS-01	BSS.F42.I&C.0820	F-42							28334A	340		2-Jun	2-Jun	20	100%	100%	Wire	20									
26	ASH2-LLD-BSS-C/L31.4	BSS-01	BSS.F42.I&C.0820	F-42							28334A	500		2-Jun	2-Jun	20	100%	100%	Wire	20									
27	ASH2-LLD-BSS-B/L37	BSS-01	BSS.F42.I&C.0820	F-42							28334A	600		2-Jun	2-Jun	20	100%	100%	Wire	20									
28	Paul Hodges	BSS-01	BSS.F42.TECH.0000	F-42										7-Jun	11-Jun		0%		Supervision	50									
29	FB1A-BSS-PVB-U7a-U	BSS-01	BSS.F42.I&C.TECH	F-42									48	7-Jun	7-Jun		0%		Terms	20									
30	FB1A-LLD-BSS-T/10-U	BSS-01	BSS.F42.I&C.TECH	F-42									6	8-Jun	8-Jun		0%		Terms	10									
31	FB1A-LLD-BSS-H/12-U	BSS-01	BSS.F42.I&C.TECH	F-42									6	8-Jun	8-Jun		0%		Terms	10									
32	FB1A-LLD-BSS-E/22-U	BSS-01	BSS.F42.I&C.TECH	F-42									6	9-Jun	9-Jun		0%		Terms	10									
33	FB1A-LLD-BSS-G/28-U	BSS-01	BSS.F42.I&C.TECH	F-42									6	9-Jun	9-Jun		0%		Terms	10									
34	FB1A-LLD-BSS-G/31-U	BSS-01	BSS.F42.I&C.TECH	F-42									6	10-Jun	10-Jun		0%		Terms	10									
35	ASH2-LLD-BSS-C/L31.4	BSS-01	BSS.F42.I&C.TECH	F-42									6	10-Jun	10-Jun		0%		Terms	10									
36	ASH2-LLD-BSS-B/L37	BSS-01	BSS.F42.I&C.TECH	F-42									6	11-Jun	11-Jun		0%		Terms	10									
37								F-32	Totals:	1450		3780	246							0									
38	OCF3-LLD-BSS-BK/19-U	BSS-01	BSS.F32.I&C.1600	F-32												50	50%	100%	Rework	100									
39	Oleary Yazzie	BSS-01	BSS.F32.I&C.0000	F-32										3-Jun	25-Jun	139	84%		Supervision	165									
40	ASH2-LLD-BSS-B/L41	BSS-01	BSS.F32.I&C.0810	F-32				N/A	Existing	0				N/A	N/A	0		0%	Conduit	0									
41	OCF3-LLD-BSS-BK/19-U	BSS-01	BSS.F32.I&C.0810	F-32	1			EMT	1"	80				3-Jun	4-Jun	40	100%	100%	Conduit	40									
42	OCF3-LLD-BSS-AT/19-U	BSS-01	BSS.F32.I&C.0810	F-32	1			EMT	1"	100				3-Jun	7-Jun	60	100%	100%	Conduit	60									
43	OCF3-LLD-BSS-AJ/18.6-U	BSS-01	BSS.F32.I&C.0810	F-32	1			EMT	1"	200				3-Jun	8-Jun	80	100%	100%	Conduit	80									
44	OCF3-LLD-BSS-AF.5/23-U	BSS-01	BSS.F32.I&C.0810	F-32	1			EMT	1"	200				7-Jun	11-Jun	74	74%	100%	Conduit	100									
45	OCF3-LLD-BSS-AT/18aS	BSS-01	BSS.F32.I&C.0810	F-32			1	EMT	1"	60				8-Jun	8-Jun	20	100%	100%	Conduit	20									

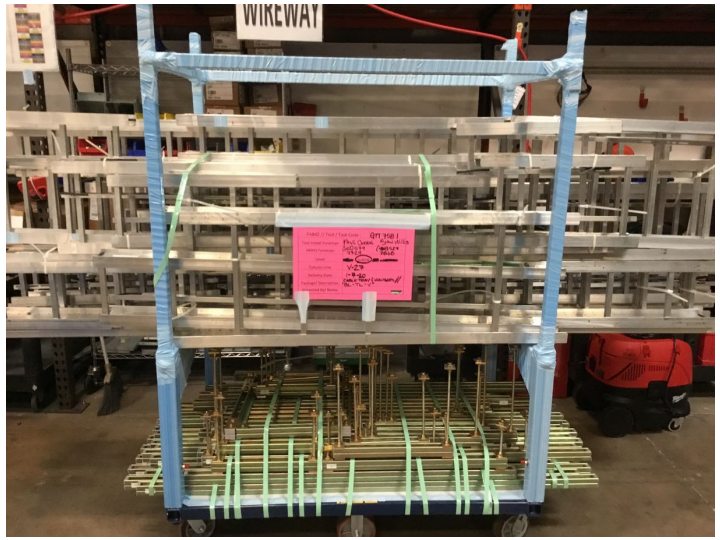
Totals | BSS | 12818 | 11808 | 30803 | 30805 | FSB VAV Demo 2nd Floor | PLC 5 IO and Equipment | Package10

5S – Organize resources to enable craft to be efficient





Standard work – make tasks consistent to get reliable production



Training to improve workforce and communication

Insights & Takeaways

Focus on Continuous Improvement

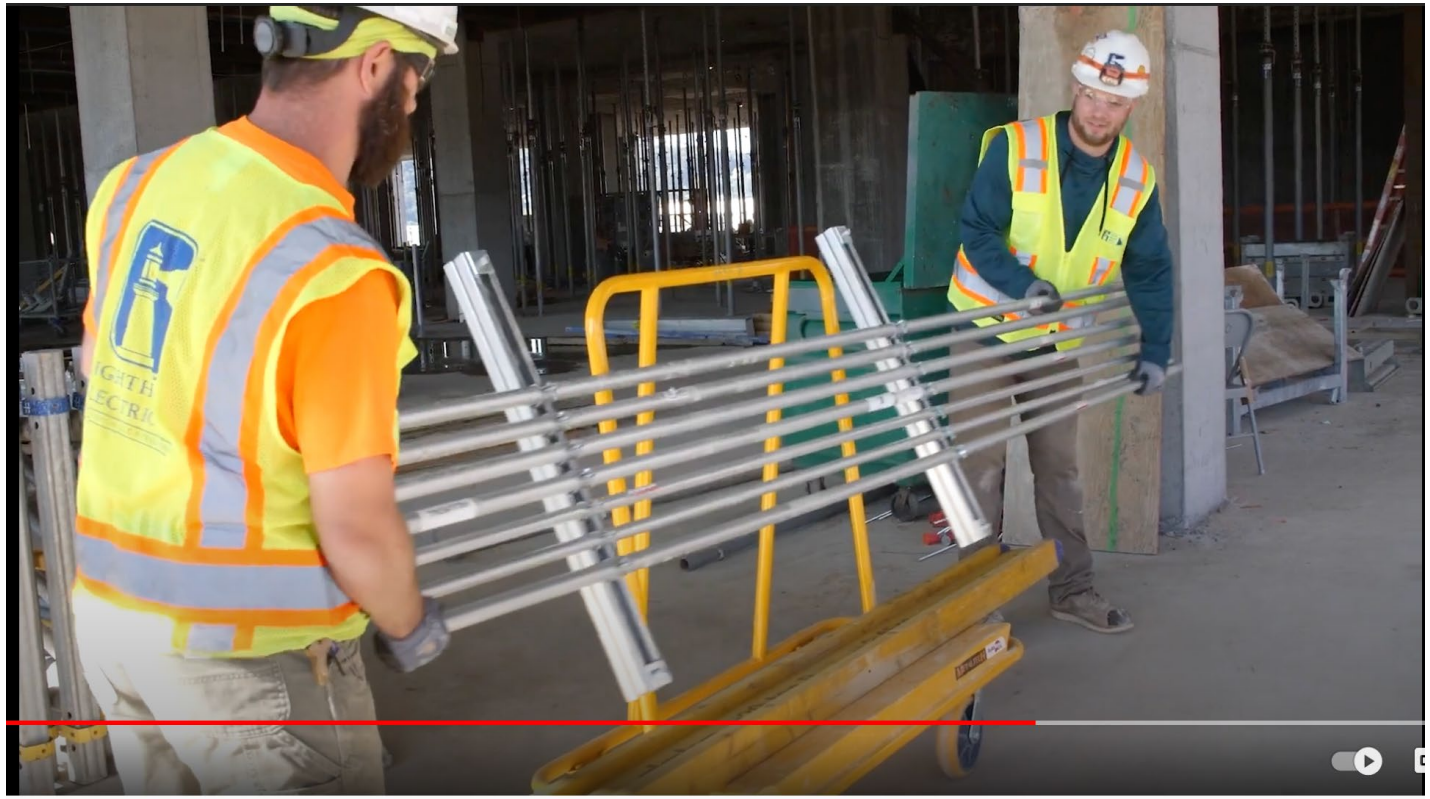
Focus on People

Focus on process

- **Fundamentals**: Plan your work, organize your tools/materials
- **Discipline**: embed lean thinking into routines and habits (training)
- **Start small:** Focus on where crews lose time -> moving materials, collecting tools, finding equipment
- **Empower Craft:** Don't wait for 'the boss' to notice the problem
- **Risk ($$$) is in the field**: Everyone should be focused on enabling craft
- **Incentives vs penalties**: acknowledgment goes a long way!

Field Crew Huddle

https://fieldcrewhuddle.leanconstruction.org/



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LCI TRADE TASK FORCE

Greg Stedman
Henry Nutt, III
Nick Masci
Tony Lowe
Rob Leicht
Perry Thompson
Matt Kittzmiller
Blake Tormey
Joe Donarumo
Elnaz Asadian

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Sean Mcguire