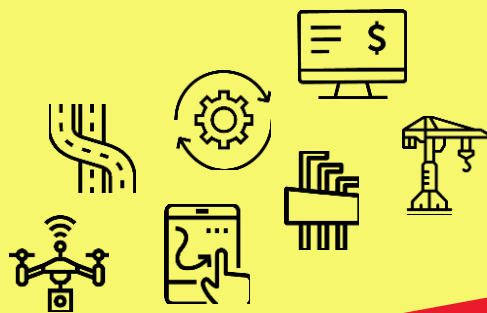


PREPARING FOR THE INDUSTRY OF TOMORROW



**The Lean Builder: A Builder's Guide to
Applying Lean Tools in the Field**

Joe Donarumo & Keyan Zandy



The following CE credits are offered for this session:



1.0 AIC CPD Credit | AGC of America has been approved to offer Continuing Professional Development (CPD) credits for qualifying programs by the [American Institute of Constructors](#) (AIC).



1.0 AIA Learning Unit (LU) | The Associated General Contractors of America is a registered provider of AIA-approved continuing education under Provider Number G523. All registered AIA CES Providers must comply with the AIA Standards for Continuing Education Programs.



1.0 CM-Lean CE Credit | AGC of America recognizes the Annual Convention as qualifying for continuing education hours towards the renewal of AGC's Certificate of Management-Lean Construction (CM-Lean).

How to earn CE hours for this session

Participants must:

1. Check in with attendance scanner at the door or in the back of the room.
2. Attend at least 95% of the session.
3. Complete the session and post-program evaluation.


Additional instructions will be emailed to attendees requesting CE credits.

For those requesting AIA credits, please provide your AIA number so we can report your attendance. You may contact **Jo-Anne Torres**, Manager of Professional Development and Continuing Education, at jo-anne.torres@agc.org or (703) 837-5360 for questions.

Learning Objectives

By the end of this session, participants will be able to:

1. Explain and describe the specific benefits of a variety of Lean tools and/or processes on a construction project.
2. Develop a plan for incorporating these practices, design own tools and successfully apply them on construction projects.
3. Measure, analyze and report on a project's progress through the use of collaborative, visual metrics and diagnose areas for focus and improvement with internal teams.
4. Identify new ways to manage, organize and build project teams and project workflows to reduce stress, improve communication, streamline workflow, improve scheduling, and reinforce mutual trust and respect with project team members and trade partners.

A photograph of two men, Joe Donarumo and Keyan Zandy, standing in a warehouse or construction site. They are both wearing black hard hats with "THE LEAN BUILDER" logo, blue-tinted safety glasses, and high-visibility yellow safety vests over dark jackets. Joe is on the left, wearing a plaid shirt under his vest. Keyan is on the right, wearing a black jacket. They are both smiling at the camera. The background shows industrial shelving and a red fire extinguisher.

Joe Donarumo

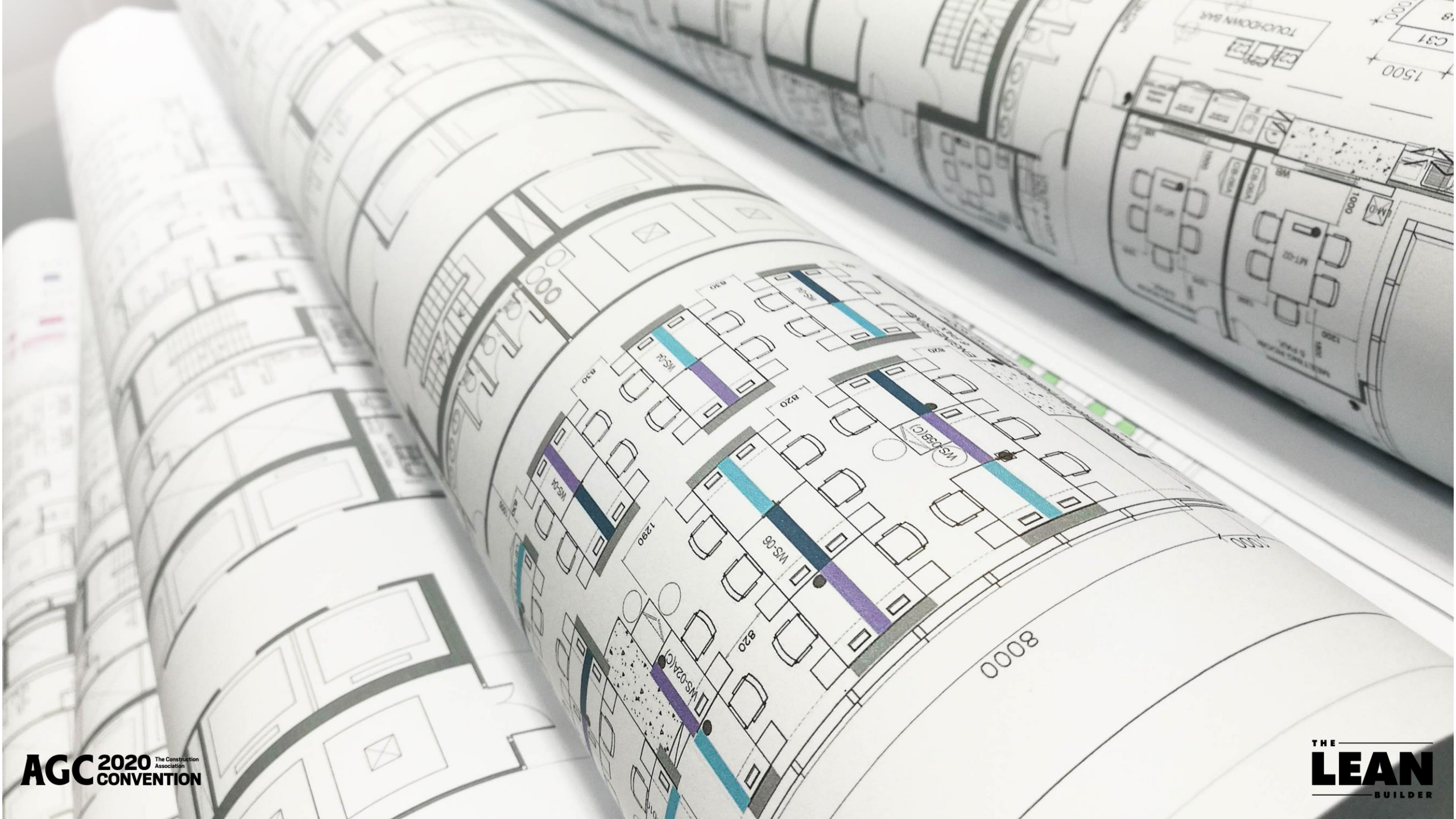
L I N B E C K

Keyan Zandy



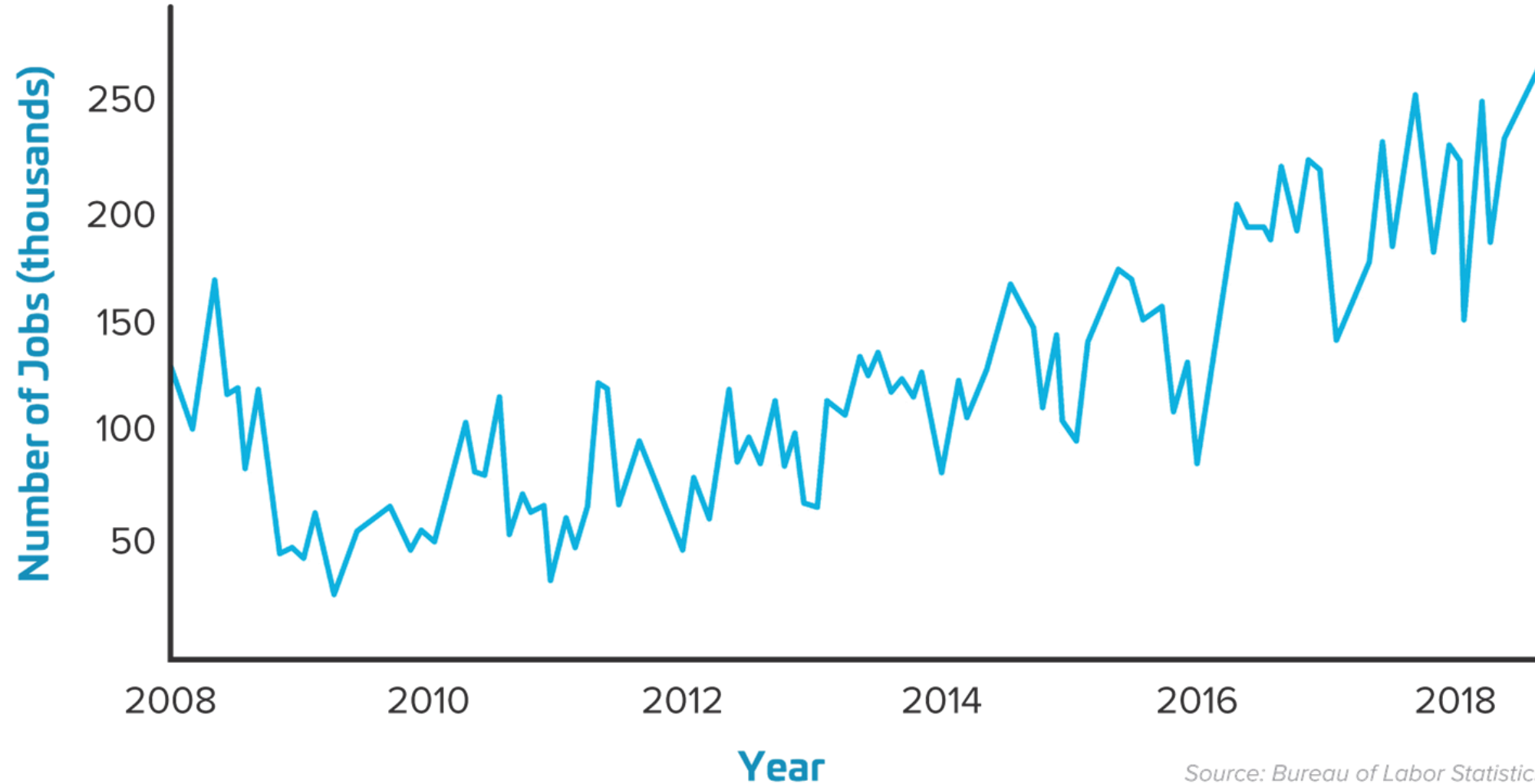
Two construction workers are standing in front of a building under construction. They are both wearing black hard hats with "THE LEAN BUILDER" logo, yellow safety vests with reflective white stripes, and sunglasses. The worker on the left is wearing a plaid shirt under his vest, and the worker on the right is wearing a dark jacket. The word "WHY" is written in large, bold, black letters across the center of the image.

WHY





Number of Unfilled Jobs in Construction

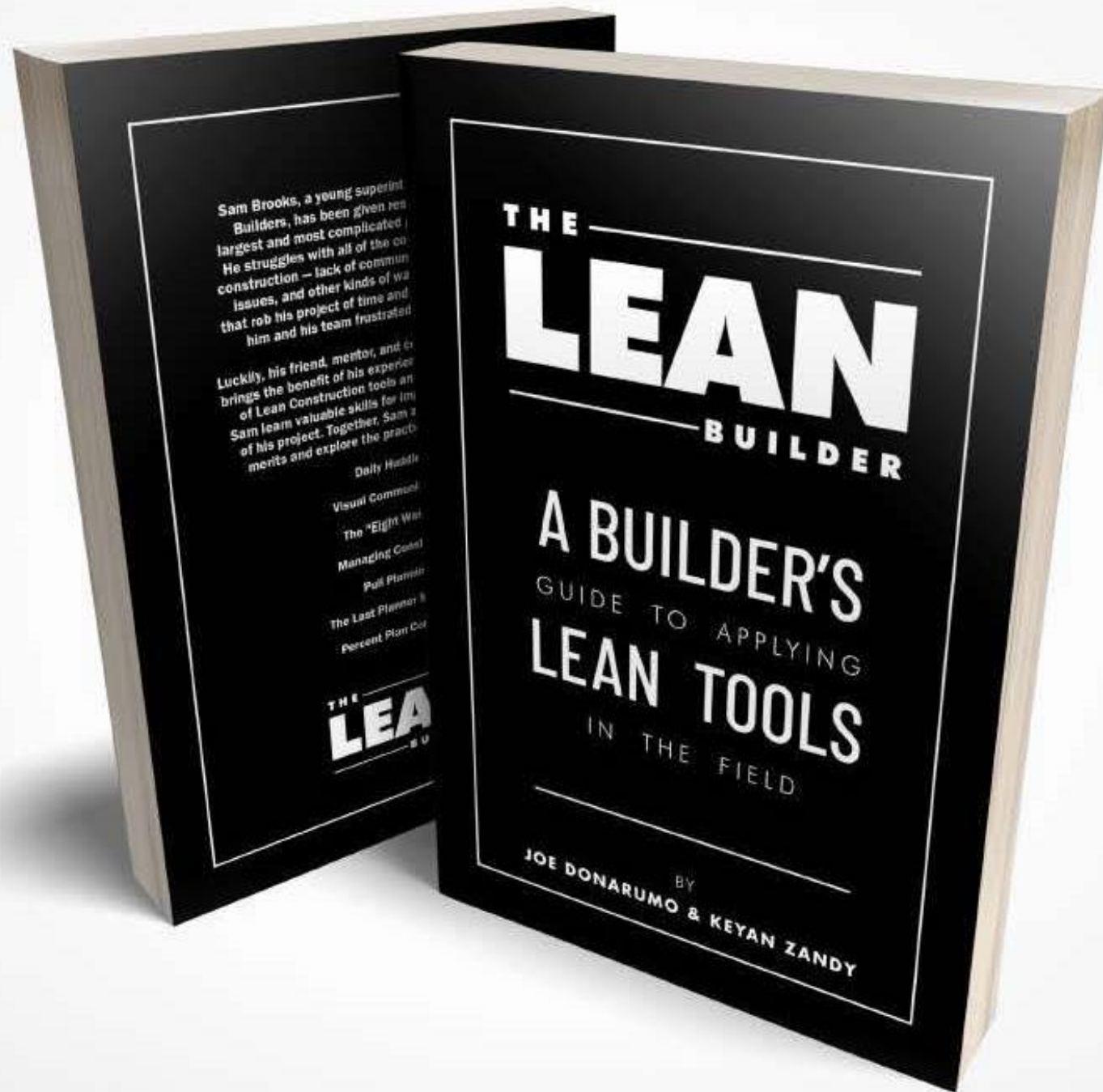


Source: Bureau of Labor Statistics









Daily Huddles



1. Keep it short.
2. Start on time, and end on time.
3. No phones or distractions.
4. Stand up.
5. Get in a routine.
6. Stay on track.
 - 2-Minute Rule / ELMO
 - The Parking Lot
7. Involve the entire team.





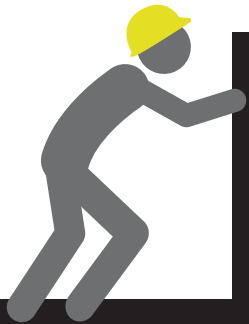
EX. WAITING AREAS

Inspections	5	5	5	5	4	5
Safety	3	3	3	3	3	
QC	2	2	2	2	2	
Inspections	2	2				
Safety	2	2	2	2		
QC			2	2	2	
Inspections	2	2				
Safety	3	2				
QC						
Inspections	4	4	4	4	4	
Safety	3	3	3	3	3	
QC	0	2	2	2	2	
Inspections	2	2	2	2	2	
Safety	1	7				
QC						



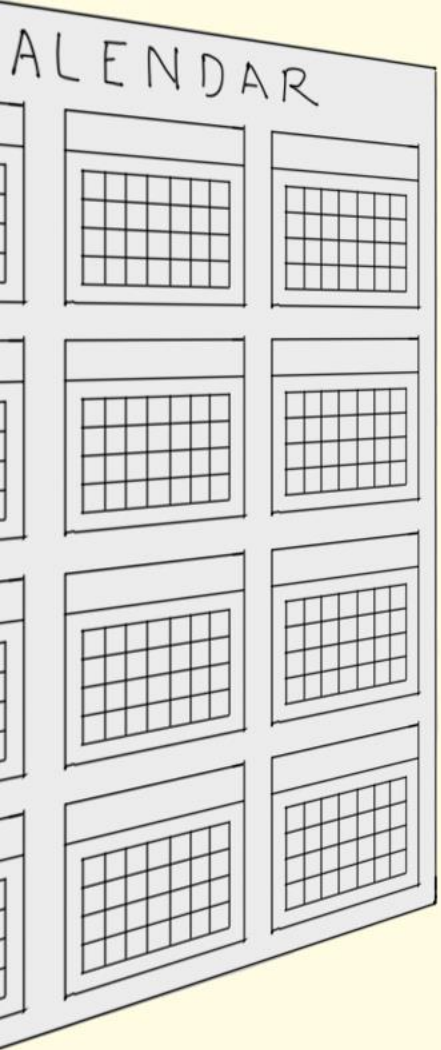


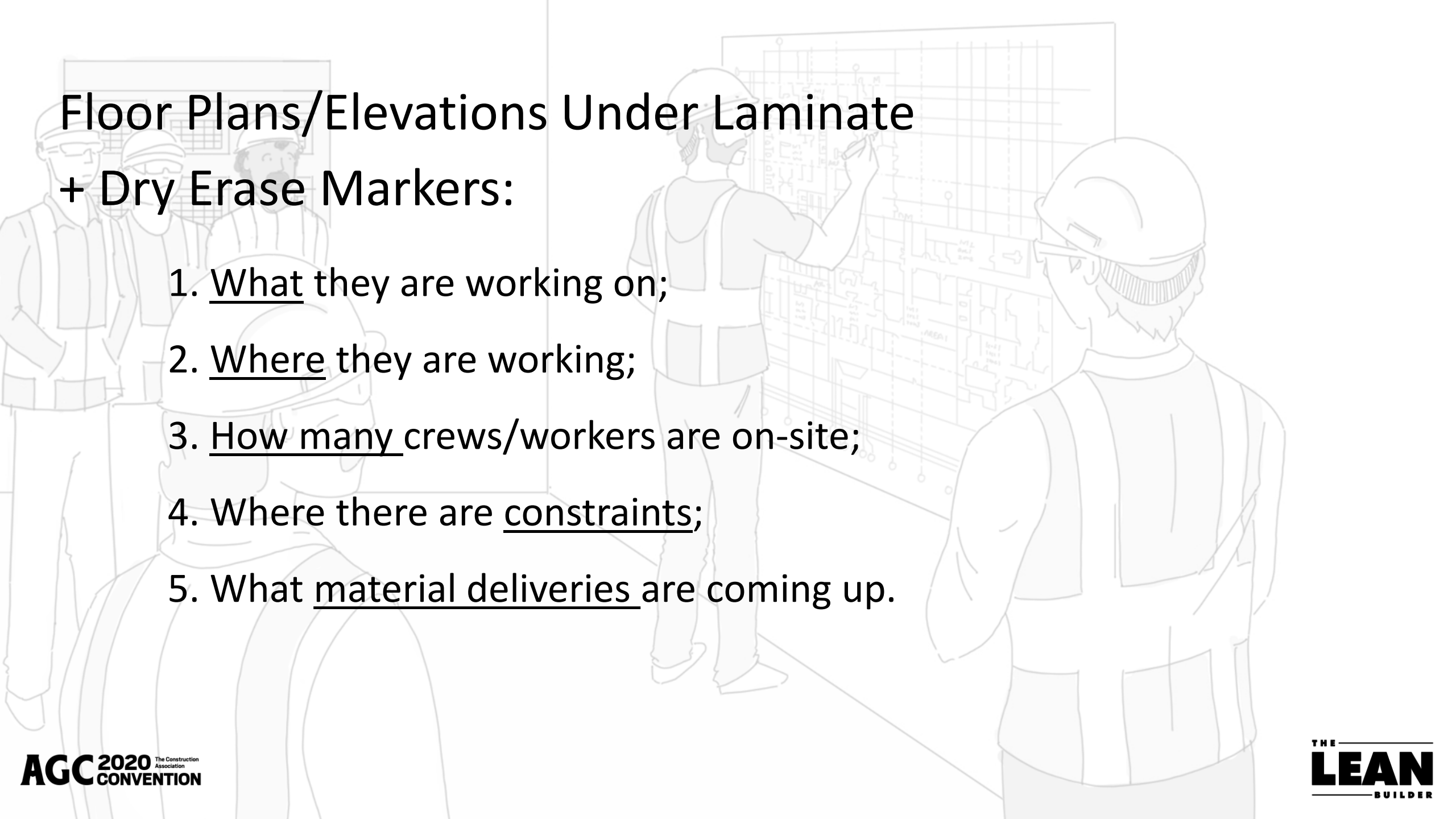
Daily Huddles



- Greater accountability amongst trade partners
- Beginning step in shifting/improving jobsite culture
- Reduced fire drills for field leaders

Visual Communication





Floor Plans/Elevations Under Laminate + Dry Erase Markers:

1. What they are working on;
2. Where they are working;
3. How many crews/workers are on-site;
4. Where there are constraints;
5. What material deliveries are coming up.



Material Delivery Boards:

1. What is being delivered?
2. What time is it being delivered?
3. What company is delivering it?
4. What type of truck is it coming in?
5. Where will it be unloaded?
6. How will it be unloaded (by hand, by lift, by crane, etc.)?

		9	10	11	12	
DELIVERY BOARD		Monday	Tuesday	Wednesday	Thursday	
1	Company/Trade	FUJI FILM		RUNNING GEAR		
2	Foreman Name/Phone Number	DAVID - 817 213 7662		DE BT 213 7662		PAV
3	Materials Being Delivered	RAD ROOM EQUIP.		CONNEX DE - MOB		F
4	Delivery Time	8 AM		9 AM		
5	Delivery Company Name	FUJI		RUNNING GEAR		CT
6	Truck Type	SEMI		SEMI / HAIL		
7	Unload Area	WEST DOORS		NORTH SIDE		E
8	Unload Method	SKYTRACK		N/A		
1	Company/Trade	ARCH FAB				
2	Foreman Name/Phone Number	DAW 817 219 0808				
3	Materials Being Delivered	CANOPY				
4	Delivery Time	7 AM				
5	Delivery Company Name	ARCH FAB				
6	Truck Type	16' TRAILER				
7	Unload Area	EAST SIDE				
8	Unload Method	SKID STEER				
1	Company/Trade					
2	Foreman Name/Phone Number					
3	Materials Being Delivered					
4	Delivery Time					
5	Delivery Company Name					
6	Truck Type					
7	Unload Area					
8	Unload Method					

Inspection Boards:

1. What is being inspected?
2. Who requested the inspection?
3. What date/time was the inspection requested?
4. What date/time will the inspection occur?
5. What are the results of the inspection?

INSPECTIONS



MONDAY	Company Trade	SKiles Group						
	Foreman name Telephone #	Sub						
	Inspection name	Rebar + M.H. insp						
	Inspection type: ie., lab, 3 rd party, City, QC	QC						
	Inspection time	All Day						
	Date inspection called in							
	Confirmation #							
Results	Pass							
TUESDAY	Company Trade	Earthworks	Concrete					
	Foreman name Telephone #	Jeff	see Procon					
	Inspection name	Area D	Rebar					
	Inspection type: ie., lab, 3 rd party, City, QC	Rebar +						
	Inspection time	10:00 AM						
	Date inspection called in	9/16						
	Confirmation #							
Results	TBD							
WEDNESDAY	Company Trade							
	Foreman name Telephone #							
	Inspection name							
	Inspection type: ie., lab, 3 rd party, City, QC							
	Inspection time							
	Date inspection called in							
	Confirmation #							
Results								
THURSDAY	Company Trade	Earthwork	Concrete	Earthwork	Concret	Plk	Plumbing	
	Foreman name Telephone #	Jeff		Terrance		Ed		
	Inspection name	Kitchen Slab	Rebar	Paving	(site)	Grease Interceptor		
	Inspection type: ie., lab, 3 rd party, City, QC	City		City		City		
	Inspection time	Unknown		Unknown		1:00 PM		
	Date inspection called in	9/17		9/18		9/16		
	Confirmation #							
Results	TBD		TBD		TBD			
FRIDAY	Company Trade							
	Foreman name Telephone #							
	Inspection name							
	Inspection type: ie., lab, 3 rd party, City, QC							
	Inspection time							
	Date inspection called in							
	Confirmation #							
Results								

Visual Communication



- Improved trade to trade communication
- Greater awareness on project direction
- Facilitates meaningful collaboration of work activities

Managing Constraints

CONFLICTS

Item #1:
What: Ceiling grid clash with ductwork
Where: Main lobby

Item #2
What: Restroom ADA conflict
Where: 2nd/3rd floor
Who: Kate Williams (Cornerstone)
When:

Item #3
What: Electrical
Where: Staff Lou

millwork conflict
vel 3.

What is the constraint?

Where is it occurring?

Who is responsible for fixing it?

When will it be resolved?

- Share the responsibility
- Review daily
- Removing constraints
- Develop and leverage your soft skills
- Build the project culture

CONSTRAINT RESOLUTION BOARD	
#	Issue/Constraint
1	BOWARDS - WHET 9/16 EST. DELIVERY
2	RETRAINING W/WH START 9/16-9/20
3	BOSWORTH HANDRAIL/DUMPSTER GATE
4	ELEVATOR ✓ LIST ↓ BELOW 9/17 STATE INSPECTION
5	POSSIBLE CONTROL WIRES → JASON 9/10
6	Z TEAM CONFIRMATION - PHOENIX 9/10
7	DOMESTIC WATER - DUMPSTER 9/10
8	PERM GAS SERVICE?
9	9/16 LEAD DUES/GASS INSTALLED - JOHN/BOBBY
10	LINBECK BANDO WORK START 9/16
11	DEDRIL HOES AND STAKES/LOT OUT STAKES STEVE 9/9
12	SET CABINETS SCALE PICTURE 9/9 - STEVE
13	PAINT W/WH CEILING 9/10 START - WILDO
14	POP 1004T 9/9 - OSCAR / POP @ LIOSS T
15	ROOFING START 9/10 - CHUCK



Managing Constraints



- Deepened accountability amongst team members
- Greater awareness of root causes
- Improved resolution speed

Last Planner System™





1. Master Scheduling

2. Phase Scheduling

3. Look-Ahead Planning

4. Weekly Work Planning

- Three-Week Look-Ahead
- Activities/Work to Be Done
- Manpower Tracking
- Constraints/Needs

5. Percent Plan Complete











1/20 (6)

HANDOFF

MECHANICAL

Windows for Drafts

(2)

HANDOFF

B ELECTRICAL

Wall Rough

3 Guys

DAYS	HANDOFF
7	Based on having high on Exam Rooms.

B ELECTRICAL

Wall Inspection

DAYS	HANDOFF



Premier Comm

Rough in Network cabling

DAYS	HANDOFF
5	Closets - Floor/wall/paint conduit

DAYS	HANDOFF
2	Testing - conduit

MECHANICAL

Ref Drain Lines

12/8

MECHANICAL

Set Condensers

(6)

DAYS	HANDOFF
3	

Premier Comm

Rough in Network cabling

DAYS	HANDOFF
7	Closet Build out Floor/Walls Plywood

DAYS	HANDOFF
3	Testing - conduits

- 
1. Master Scheduling
 2. Phase Scheduling
 3. Look-Ahead Planning
 4. Weekly Work Planning
 - Three-Week Look-Ahead
 - Activities/Work to Be Done
 - Manpower Tracking
 - Constraints/Needs
 5. Percent Plan Complete

MRCM Vertical Expansion 7/13/19		Week 1 July 15, 2019							Week 2 July 22, 2019							Week 3 July 29, 2019							Week 4 August 5, 2019							Week 5 August 12, 2019							Week 6 August 19, 2019							FACILITY IMPACTS					
ID#	Task	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S													
1	ENVELOPE	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25						
2	5th floor balconies frame/glaze	●	●	●	●	●																																											
3	Coping cap at metal panels	●	●	●	●	●																																											
4	Build back 4th floor west balcony	●	●	●	●	●				●	●	●	●																																				
5	Spandrel infill glass area B	●	●	●	●	●				●	●	●	●	●	●																																		
6	Metal panels east wing walls									●	●	●	●	●	●			●	●	●	●	●	●																										
7	Install stainless steel at west wing wall									●	●	●																																					
8	4 east balcony demo																●	●	●	●	●	●																											
9	Spandrel infill glass area A																●	●	●	●	●	●																											
10	Metal panels at east wing walls																	●	●	●	●	●	●							●	●	●	●	●	●														
11	4 east balcony build back																	●	●	●	●	●	●							●	●	●	●	●	●			●	●	●	●	●	●						
12																																																	
13	Interior	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25						
14	Area C																																																
15	South plumbing fixtures	●	●	●	●	●																																											
16	Shot blast concrete	●	●	●	●	●				●	●																																						
17	South light install	●	●	●	●	●				●	●																																						
18	Above ceiling punch at S/R ceilings		●	●	●	●																																											
19	Flooring C north			●	●	●				●	●	●	●	●	●			●	●																														
20	Interior Glazing area C				●	●				●	●	●	●	●	●			●	●	●	●	●			●	●	●																						
21	Rock sheetrock ceilings									●	●	●	●	●	●																																		
22	Flooring C south											●	●					●	●	●	●	●			●	●	●																						
23	Millwork																●	●	●	●	●	●			●	●	●	●	●																				
24	Tape/bed and prime S/R ceilings																●	●	●	●	●	●			●	●	●																						
25	Flooring C core																	●	●	●					●	●	●	●	●			●	●																
26	Corridor grid																		●	●	●	●	●			●	●	●	●	●																			
27	Faucets at millwork																								●	●	●	●	●			●	●	●	●	●													
28	Ceiling mounted devices at corridors																													●	●	●	●	●	●			●	●	●	●	●							
29	First coat final paint																													●	●	●	●	●	●			●	●	●	●	●							
30	wall protection																																														thru 8/30		
31	Interior	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25						
32	Area B																																																
33	Grid north	●	●	●	●	●																																											
34	Tile at north restrooms	●	●	●	●	●	●			●	●	●	●																																				
35	Tile at Corridor B					●	●			●	●	●	●	●																																			
36	Grid north									●	●	●	●	●	●																																		
37	Grid south									●	●	●	●	●	●																																		
38	Shot blast concrete									●	●	●	●	●																																			

THREE WEEK LEAN DASHBOARD:



32

PROJECT NAME



8

TIMEFRAME

PROJECT MILESTONE TRACKING

MILESTONE	DATE	MILESTONE	DATE
RTU7 START UP	2-11		
MILESTONE	DATE	MILESTONE	DATE

LAST PLANNER TRACKING

3 WEEK LOOK-AHEAD PLANNING

ACTIVITY / WORK TO BE DONE		CONSTRAINTS / NEEDS	PREREQUISITE	3 WEEK LOOK-AHEAD PLANNING																											
An identifiable unit of work.		An item or requirement that will prevent an activity from starting, advancing or completing as planned.	Work done by others that serves as an input or substrate for work to begin.																												
				WEEK:																											
				DAY:																											
				PPC TRACKING																											
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SKILES GROUP'S LEAN SCOREBOARD

WEEK OF:	12-14-2016		
02	26	247	
PIESTONE	OVERALL	GETTING	REMOVED

Ductwork

Armed 1/31

LAST PLANNER TRACKING			3 WEEK LOOK-AHEAD PLANNING												
ACTIVITY / WORK TO BE DONE <small>An identifiable unit of work.</small>		CONSTRAINTS / NEEDS <small>An item or requirement that will prevent an activity from starting, advancing or completing as planned.</small>	PREREQUISITE <small>Work done by others that serves as an input or substrate for work to begin.</small>												
1	Duct Work Roof Area C			WEEK: 4	5	6	7	8	9	10	11	12	13	14	15
2	Duct Tie INg to Units			DAY: 4	5	6	7	8	9	10	11	12	13	14	15
3	Duct Area B Patient Rooms			W	TH	F	S	SU	M	TU	W	TH	F	S	SU
4	Duct Area B corridor	Duct Area B Patient Rooms		5	5	5	5	5							
5	Insulate AHU #8 doghouse			5	5	5	5	5							
6	Chill Water Risers - 5th Area C									5	5	5	5	5	
7	Heating Water Riser - 5th Area A	TEMP PROTECTION	Open Area C Chase Open Area A Roof												
8	Insulate AHU #7														
9	Insulate AHU #9														
10															
11	AHU - 8 Steam piping Testing														
12	HEATING WATER AREA A OVERHEAD 4" ONLY AHU		MATERIAL												
13	HEATING WATER RAISERS FROM 6 TO 5														
14	Sanitary waste Vent Area A														
15	Domestic water Area B north overhead														
16	Domestic water IN-WALL Area C														
17															
18	wire pull MCC TO AHU's														
19	Wire pull MCC TO CUP														
20	Overhead Rough AHU 7,8,9 (Main Rack)														
21	Posthouse Elec Room Rough														
22	AHU 7 Rough														
23	AHU 9 Rough														
24	AHU 8 Rough														
25	Area B Core (N) Overhead Rough														
26	Area B Core (S) Overhead Rough														
27	Area C Core (S) Overhead Rough														
28	Area A Overhead North														
29	Area C Core (N) Overhead Rough														
30	Area A Overhead South														

CURRENT WEEK SNAPSHOT

ACTIVITIES COMPLETED: 19

ACTIVITIES PROMISED: 32

CURRENT TEAM SCORE: 59%

ROOT CAUSE ANALYSIS

12-WEEK SNAPSHOT

DATE RANGE: 1-11-18 to 1-11-19

12 WEEK PERCENT PLAN COMPLETE TEAM PERFORMANCE

WEEK	1	2	3	4	5	6	7	8	9
ACTIVITIES COMPLETED	23	28	32	32					
ACTIVITIES PROMISED	17	12	24	19					
TEAM PERFORMANCE	74	59	73	59					

12 WEEK ROOT CAUSE ANALYSIS

WEEK	1	2	3	4
ACTIVITIES COMPLETED	1	3	1	1
ACTIVITIES PROMISED	1	3	3	7
TEAM PERFORMANCE	1	5	2	3
TOTAL	6	12	8	13





LINBECK

2 WEEK LOOK-AHEAD BOARD

PROJECT NAME:

PROJECT #:

PPC Root Causes: 1. Inclement Weather 2. Inadequate Manpower 3. Lack of/Failure of Machinery 4. Design (RFI, Submittals, Etc.) 5. Make Ready 6. Materials 7. Poor Scheduling

PPC

Root Cause

9 10 11 12 13 14

CONSTRAINTS

#	TASKS	Pre Request	V/N	#	Mon	Tue	Wed	Thur	Fri	Sat	Sun	Mon	Tue	Wed	Thur	Fri	Sat	Sun	CONSTRAINTS
1	• DFW • TRICE • MAREK • KLUKRE • FISK	Safety QC																	
2	• VADENS • PAFA • FAB FLOORS • ANTON	Inspections																	
3	Doors and Hardware	Safety QC																	
4	Cerking tile complete	Inspections																	
5	Wire pulled in Both lobbies (FIRE ALARM)	Safety QC																	
6		Inspections																	
7	FLOORING LEVEL 1	Safety QC																	
8	FLOORING LEVEL 2	Inspections																	
9	2ND FLOOR COMPLETE 1ST COAT	Safety QC																	
10	PAINT 1ST FLOOR (EXCEPT FINAL COAT)	Inspections																	
11	LYNN PAINT	Safety QC																	
12	CALKING THE EXT WALLS ON 2ND FLOOR AROUND THE GLDN	Inspections																	
13	COMPLETE BEAM 360 ITEMS	Safety QC																	
14	Anton - Mill/walk (Green area)	Inspections																	
15	level 1 reception desk	Safety QC																	
16	level 1 - Exam room mill/walks (Purple)	Inspections																	

24	level 2 - reception desk	Safety QC																	
25	Ceiling device install	Inspections																	
26	Wall device install	Safety QC																	
27	Site lighting	Inspections																	
28		Safety QC																	
29	INSTALL FRABIZ DUCT	Inspections																	
30	ABOVE CEILING QA/QC, GROVE TRIMOUT	Safety QC																	
31		Inspections																	
32	Columns	Safety QC																	
33	Scaffold	Inspections																	

14 DAYS
C.O.

MASTER SCHED

THE LEAN BUILDER

3 3 3

THIS WEEK'S MILESTONES

MILESTONES

#	Date		#	Date	
1	9/10	LIGHTING/RECEP PRECX	8	9/13	ROOF CAP 100%
2	9/11	CCMC PURPLE CEILING INSP	9	9/13	DOOR PRE CX
3	9/11	PLUMB PRECX	10	9/13	PLUMBING CX
4	9/10	LIFESAFETY/FE PRECX	11		
5	9/12	LIFESAFETY/FE CX	12		
6	9/12	RECEP/LIGHTING CX	13		
7	9/13	ACCESSORIES 100%	14		





1. Master Scheduling

2. Phase Scheduling

3. Look-Ahead Planning

4. Weekly Work Planning

- Three-Week Look-Ahead
- Activities/Work to Be Done
- Manpower Tracking
- Constraints/Needs

5. Percent Plan Complete



THREE WEEK LEAN DASHBOARD:



32

PROJECT NAME



8

TIMEFRAME

PROJECT MILESTONE TRACKING

MILESTONE	DATE	MILESTONE	DATE
RTU7 START UP	2-11		
MILESTONE	DATE	MILESTONE	DATE

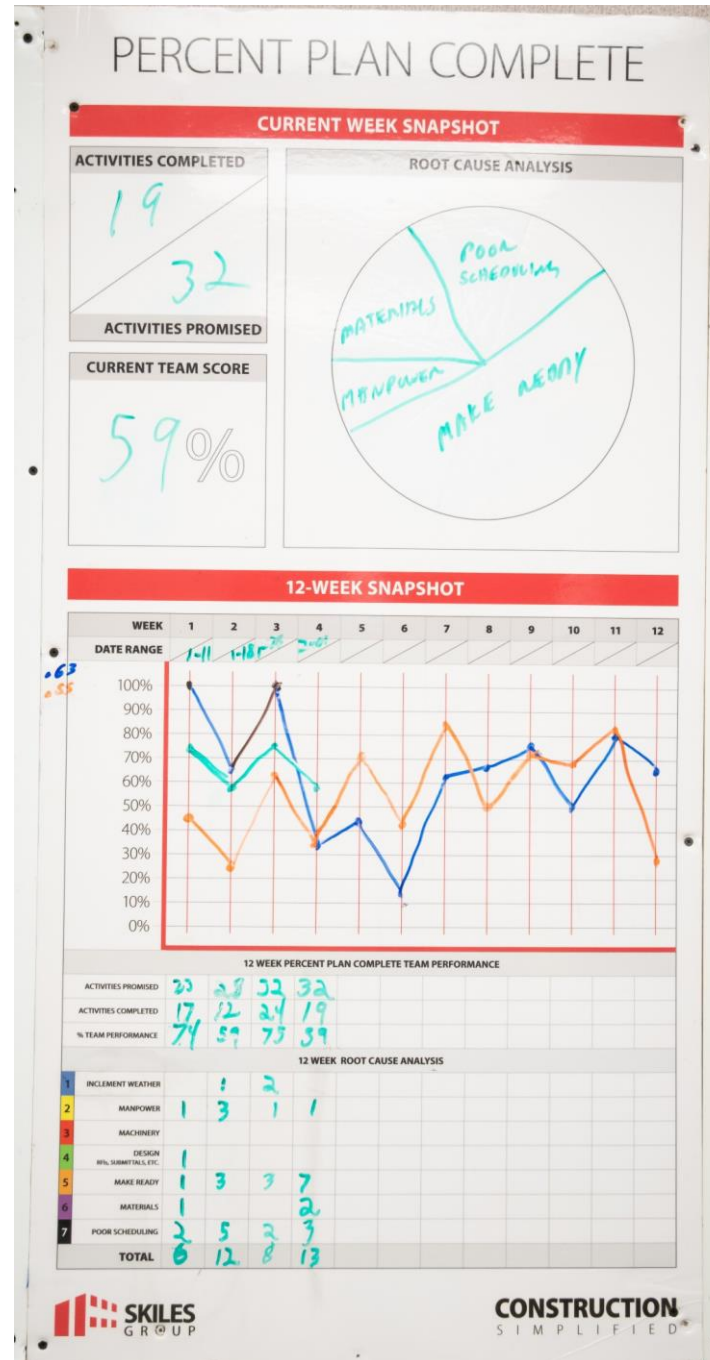
LAST PLANNER TRACKING

3 WEEK LOOK-AHEAD PLANNING

ACTIVITY / WORK TO BE DONE		CONSTRAINTS / NEEDS	PREREQUISITE	3 WEEK LOOK-AHEAD PLANNING																											
An identifiable unit of work.		An item or requirement that will prevent an activity from starting, advancing or completing as planned.	Work done by others that serves as an input or substrate for work to begin.																												
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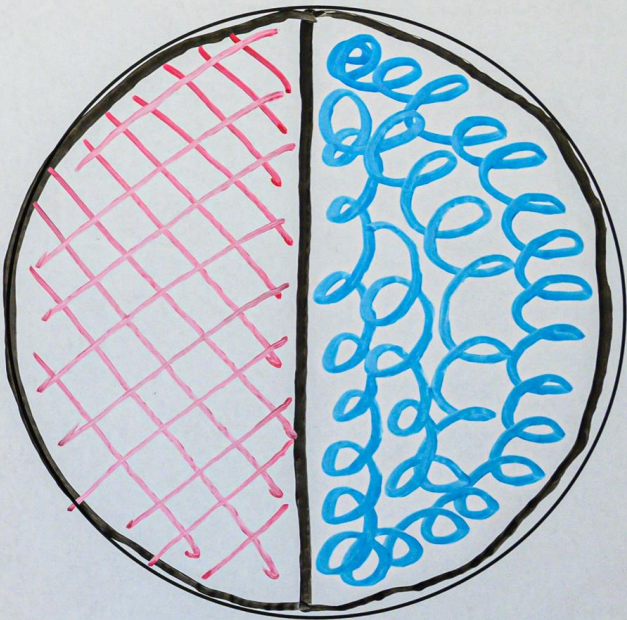
5. Percent Plan Complete

- Activities Completed
- Activities Promised
- Weekly Team Percentage
- Root Cause Categories
- Root Causes for Work Missed
- 12-Week Snapshot





LINBECK

	Week 1 3/23	Week 2 3/30	Week 3 4/6	Week 4	Week 5	Week 6
100%						
95%						
90%						
85%						
80%						
75%						
70%						
65%						
60%						
55%						
50%						
45%						
40%						
35%						
30%						
25%						
20%						
15%						
10%						
5%						
# of Operations Promised	20	20	23			
# of Operations Completed	17	18	21			
% Team Performance	85%	90%	91%			
REASONS PROMISED ITEMS NOT COMPLETED						
Inclement Weather						
Inadequate Manpower		1				
Lack of/Failure of Machinery						
Design (RFI, Submittals, Etc.)						
Make Ready	3	1				
Materials			1			
Total						



LEGEND

Inclement Weather		Make Ready
Inadquate Manpower		Materials
Lack of/Failure of Machinery		Poor Scheduling
Design (RFI, Submittals, Etc.)		

Last Planner System™



- A trade-validated schedule (Pull not Push)
- Improved constraint identification/resolution of critical activities in look-ahead schedules
- Clear team understanding of weekly milestones and learning around failures (PPC)

Q&A