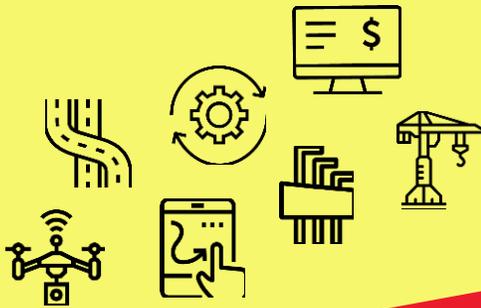


PREPARING FOR THE INDUSTRY OF TOMORROW



**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.



Joe Donarumo

L I N B E C K

Keyan Zandy

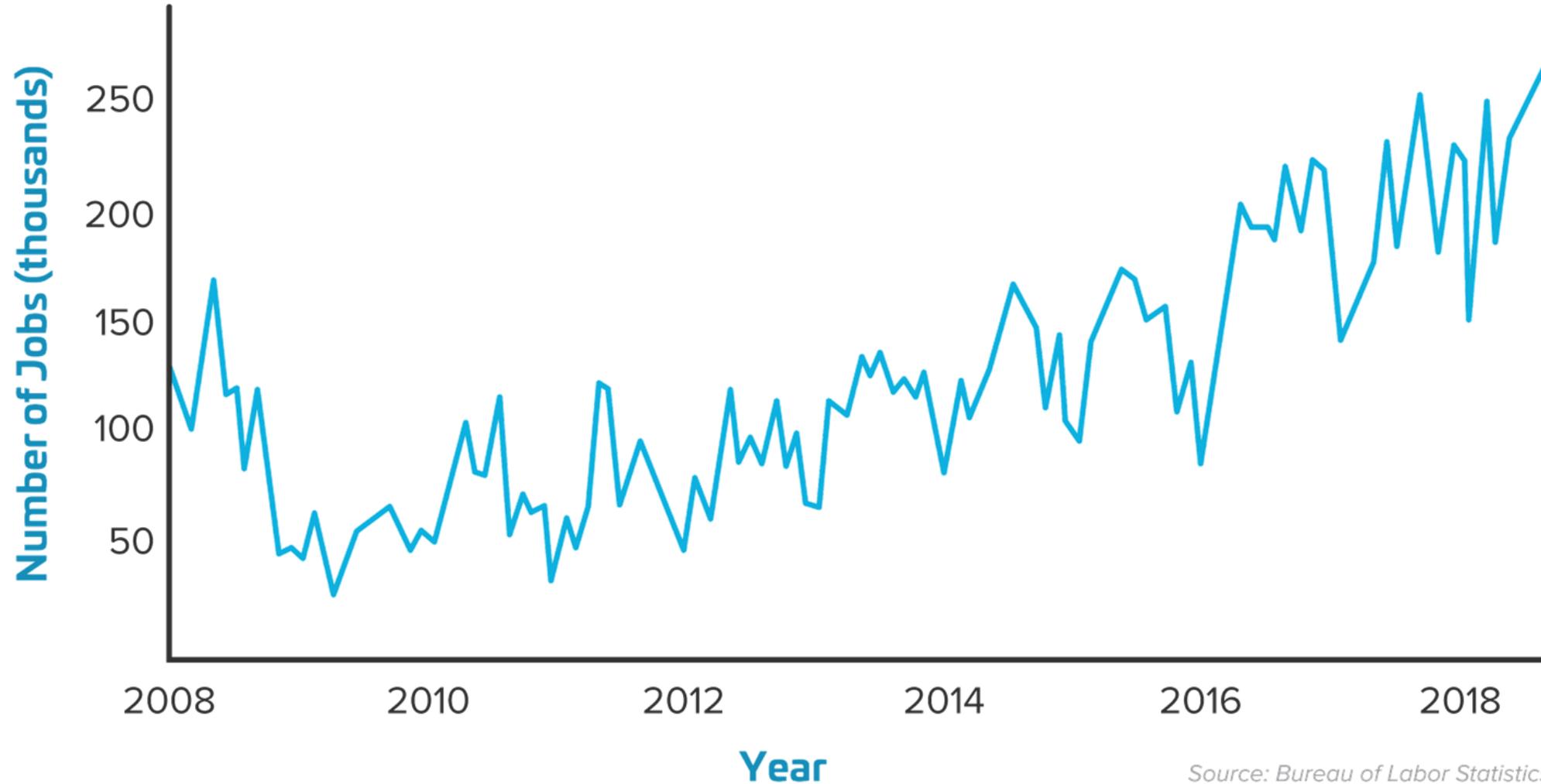


Two construction workers are standing in a hallway, facing the camera. They are both wearing black hard hats with "THE LEAN BUILDER" written on them, and high-visibility yellow safety vests over dark long-sleeved shirts. The worker on the left is also wearing a plaid shirt under his vest and sunglasses. The worker on the right is wearing sunglasses and has a beard. The word "WHY" is written in large, bold, black letters across the center of the image, partially overlapping the workers.

WHY



Number of Unfilled Jobs in Construction



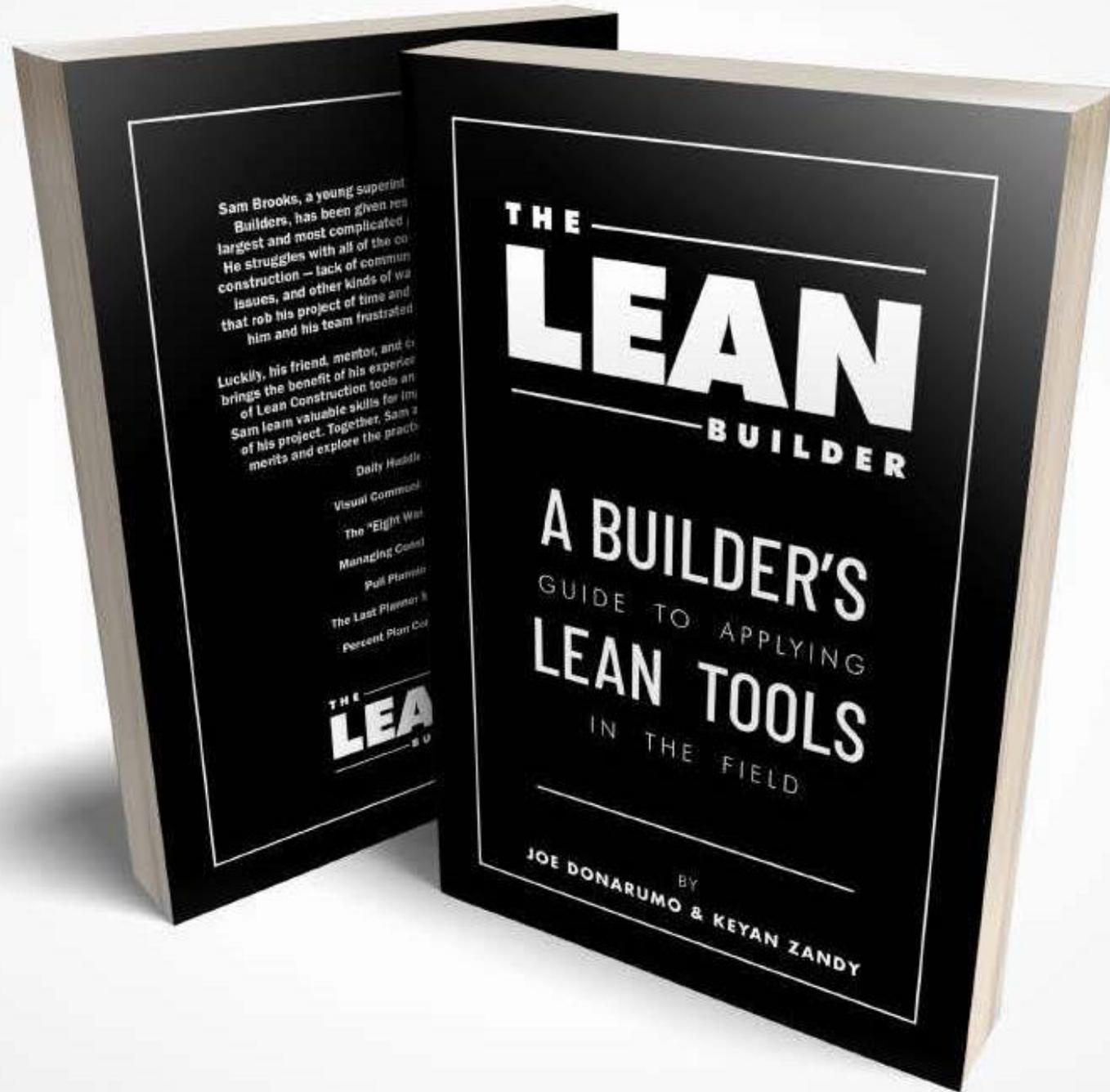
Source: Bureau of Labor Statistics



AGC 2020 The Construction Association
CONVENTION

THE
LEAN
BUILDER





Sam Brooks, a young superintendent Builders, has been given the largest and most complicated project. He struggles with all of the common construction – lack of communication, issues, and other kinds of waste that rob his project of time and money, and his team frustrated.

Luckily, his friend, mentor, and boss brings the benefit of his experience of Lean Construction tools and Sam learn valuable skills for the success of his project. Together, Sam and his mentor explore the practical

- Daily Huddle
- Visual Control
- The "Eight Wastes"
- Managing Change
- Pull Planning
- The Last Planner System
- Percent Plan Complete

THE LEAN BUILDER

THE
LEAN
BUILDER

A BUILDER'S
GUIDE TO APPLYING
LEAN TOOLS
IN THE FIELD

BY
JOE DONARUMO & KEYAN ZANDY

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.





EXL WAITING AREAS

555545

55555

33333
22222

22
222

222
222
32

444444
333333
022222

22222
17



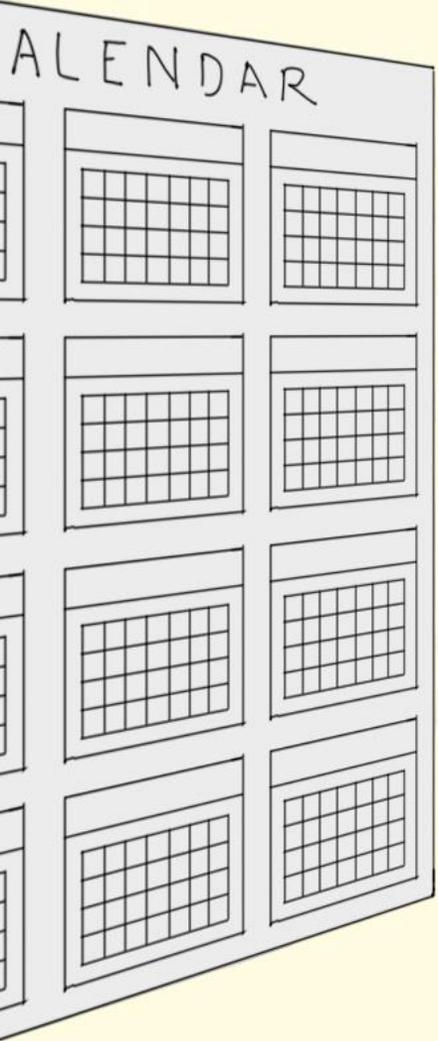


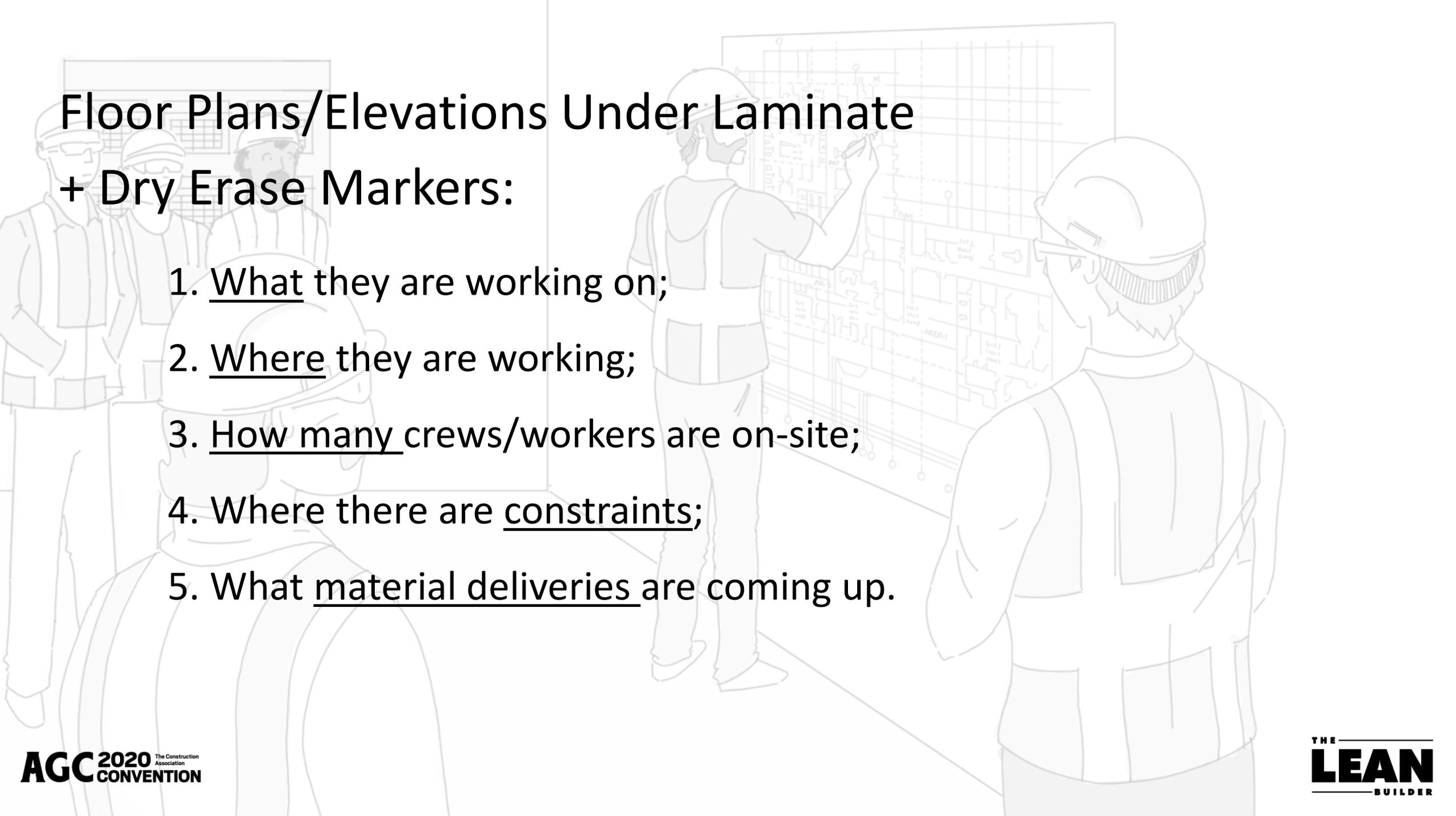
Daily Huddles



- 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:

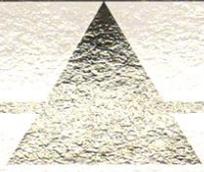
1. What is being delivered?
2. What time is it being delivered?
3. What company is delivering it?
4. What type of truck is it coming in?
5. Where will it be unloaded?
6. How will it be unloaded (by hand, by lift, by crane, etc.)?

9

10

11

12



DELIVERY BOARD

Monday

Tuesday

Wednesday

Thursday

1	Company/Trade
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
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
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

FUJI FILM
 DAVID - 817 213 7662
 RAD ROOM EQUIP.
 8AM
 FUJI
 SEMI
 WEST DOORS
 SKYTRACK

ARCH FAB
 JAW 817 219 0808
 CANOPY
 7 AM
 ARCH FAB
 16' TRAILER
 EAST SIDE
 SKID STEER

RUNNING GEAR
 JOE 817 213 7662
 CONNEX DE - MOB
 9 AM
 RUNNING GEAR
 SEMI / HAIL
 NORTH SIDE
 N/A

PAV
 F
 C
 E

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

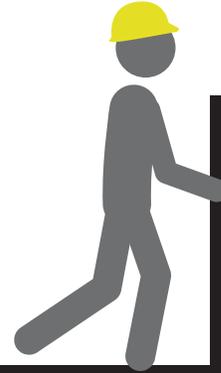
When will it be resolved?

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

CONSTRAINT RESOLUTION BOARD	
#	Issue/Constraint
1	BOWARDS - W/RET 9/16 EST. DELIVERY
2	RETAINING WALL START 9/16 - 9/20
3	BOSWORTH MANHOLEL / DUMPSTER GATE
4	ELEVATOR ✓ LIST ↓ BELOW 9/17 STATE INSPECTION
5	POSSIBLE CONTROL WIRES → JASON 9/10
6	Z TRIM CONFIRMATION - PHOENIX 9/10
7	DOMESTIC WATER - DUMPTRUCK 9/10
8	PERM GAS SERVICE?
9	9/10 LEAD PIPES / GASS INSTALLED - JOHN / BOBBY
10	LINBECK BANDO WORK START 9/16
11	DEDRIL HOLES AND STAIRS / CUT OUT SLOTTES STEVE 9/9
12	SET CABINETS SCALE POLUME 9/9 - STEVE
13	PAINT WITH CEILING 9/10 START - WILDO
14	POP 1004T 9/9 - OSCAR / POP @ CROSS 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











7/10 (6)
HANDOFF

MECHANICAL
windows
for drafts
②
HANDOFF

C

C

D

D

B

C

C

D

D

B

C

C

D

B

B

C

C

MECHANICAL
Ref Drain Lines
12/18
MECHANICAL
Set Condensers
⑥
DAYS HANDOFF
7

B

B ELECTRICAL
Wall Rough
3 Guys
DAYS HANDOFF
7
Based on having light on Exam Room.

MILESTONE

C

D

B

B

C

C

D

B

B ELECTRICAL
Wall Inspection
DAYS HANDOFF

Premier Comm
Rough in Network
cabling
DAYS HANDOFF
5
Closets - Floor/wall/panel
conduct

DAYS HANDOFF
2
Fishing - conduit

Premier Comm
Rough in Network
cabling
DAYS HANDOFF
7
Closet Build out
Floor/Walls
Flywood

DAYS HANDOFF
3
Fishing - 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

MPMC 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	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 south restrooms					•	•		•	•	•	•	•																																					
37	Grid south								•	•	•	•	•																																					
38	Shot blast concrete								•	•	•	•	•																																					



32

PROJECT NAME



8

TIMEFRAME

PROJECT MILESTONE TRACKING			
MILESTONE	DATE	MILESTONE	DATE
RTU 7 START UP	2-11		
MILESTONE	DATE	MILESTONE	DATE

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>	WEEK																											
			DAY:																											
			4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
1 Duct Work Roof Area C.		SAFETY INSPECTIONS																												
2 Duct Tie INS to Units		SAFETY INSPECTIONS																												
3 Duct Area B Patient Rooms	DUCT RISER @ PUBLIC RR	SAFETY INSPECTIONS																												
4 Duct Area B corridor		SAFETY INSPECTIONS																												
5 Insulate AHU #8 abghouse		SAFETY INSPECTIONS																												
6 Chill Water Risers - 5th Area C	TEMP PROTECTION	SAFETY INSPECTIONS																												
7 Heating Water Riser - 5th Area A		SAFETY INSPECTIONS																												
8 Insulate AHU #7		SAFETY INSPECTIONS																												
9 Insulate AHU #9		SAFETY INSPECTIONS																												
10		SAFETY INSPECTIONS																												
11 AHU - 8 Steam Piping Testing		SAFETY INSPECTIONS																												
12 HEATING WATER AREA A OVERHEAD 4" ONLY		SAFETY INSPECTIONS																												
13 HEATING WATER RAISERS FROM 6 TO 5		SAFETY INSPECTIONS																												
14 Sanitary waste Vent Area A		SAFETY INSPECTIONS																												
15 Domestic water Area B north overhead		SAFETY INSPECTIONS																												
16 Domestic water IN-WALL Area C		SAFETY INSPECTIONS																												
17		SAFETY INSPECTIONS																												
18 wire pull MCC TO AHU'S		SAFETY INSPECTIONS																												
19 Wire pull MCC TO CUP		SAFETY INSPECTIONS																												
20 Overhead Rough AHU 7,8,9 (Main Rack)		SAFETY INSPECTIONS																												
21 Penthouse Elec Room Rough		SAFETY INSPECTIONS																												
22 AHU 7 Rough		SAFETY INSPECTIONS																												
23 AHU 8 Rough		SAFETY INSPECTIONS																												
24 AHU 9 Rough		SAFETY INSPECTIONS																												
25 Area B Rack (N) overhead Rough		SAFETY INSPECTIONS																												



SKILES GROUP'S LEAN SCOREBOARD

LEARN: SKILES GROUP'S LEAN SCOREBOARD
 WEEK OF: 12-14-2016
 MILESTONE: -02
 OVERALL: 26
 REVENUE: 247



LAST PLANNER TRACKING

3 WEEK LOOK-AHEAD PLANNING

WORK TO BE DONE	CONSTRAINTS / NEEDS	PREREQUISITE	3 WEEK LOOK-AHEAD PLANNING																					
			WEEK 11	WEEK 12				WEEK 13																
			MON	TUE	WED	THU	FRI	SAT	SUN	MON	TUE	WED	THU	FRI	SAT	SUN	MON	TUE	WED	THU	FRI	SAT	SUN	
Y			2	2	2																			
Y			2	2	2	2				2	2	2	2				2	2	2	2				
Y			2	2																				
Y			2	2	2	2																		
Y	Need Temp Lighting		6	6	6	6	6			6	6	6	6				6							
Y			2	2	2	2																		
Y			4	4	4	4				4														
Y			2	2	2	2				2	2	2	2											
Y			4	4	4	5				5	5	5	5											
Y			2	2																				
Y			2	2																				
Y			1	1	1	1				1	1	1	1											
Y			2	2						2	2	2	2											
Y			2	2						2	2	2	2											

LINBECK

2 WEEK LOOK-AHEAD BOARD

PROJECT NAME:

PROJECT #:

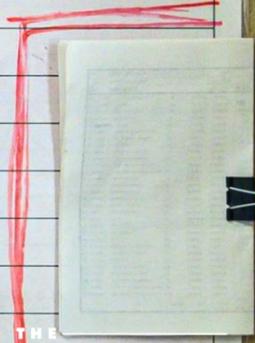
PPC Root Causes: 1. Incomplete Weather 2. Inadequate Manpower 3. Lack of/Failure of Machinery 4. Design (RFI, Submittals, Etc.) 5. Make Ready 6. Materials 7. Poor Scheduling

#	TASKS	Pre Request	V/N	Root Cause #	9 10 11 12 13 14							CONSTRANTS						
					Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun
1	• DFW • TRICE • MAREK • KUKRE • FISK	Safety QC																
2	• VADENS • PAFA • FAB FLOORS • ANTON	Safety QC																
3	Doors and Hardware	90%				3	3	3	1	1								MISSING HARDWARE/ GEN PAD DOORS
4	Cerking tile complete	100%				2	2	2	4	4								
5	Wire pulled in Both lobbies (FIRE ALARM)	100%				1	2											
6																		
7	FLOORING LEVEL 1	90%				5	5	5	4	5								EX WAITING AREAS
8	FLOORING LEVEL 2	10%								1		5	5	5	5			
9	2ND FLOOR COMPLETE 1ST COAT	100%				3	3	3	3	3								
10	PAINT 1ST FLOOR (EXCEPT FINAL COAT)	100%				2	2	2	2	2								
11	GYM PAINT																	
12	CALKING THE EXT WALLS ON 2ND FLOOR AROUND THE BLDG	100%				2	2											
13	COMPLETE BEAM 360 STEMS	100%						2	2	2								
14	Anton - Mill/walk (Green area)	100%					2	2	2	2								
15	level 1 reception desk	100%					2	2	2									
16	level 1 - Exam room mill/walk (Purple)	100%				3	2											

24	level 2 - reception desk	100%				2												
25	Ceiling device install	99%				4	4	4	4	4								
26	Wall device install	99%				3	3	3	3	3								
27	Site lighting	20%				0	2	2	2	2								
28																		
29	INSTALL FABRIC DUCT	100%				2	2	2	2	2								
30	ABOVE CEILING QA/QC, GROVE TREAT	100%				1	1											
31																		
32	AGC 2020 CONVENTION Columbus	100%				2	2											
33	Scaffold	100%				2												

14 DAYS C.O.

MASTER SUSH



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	9/12	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





32

PROJECT NAME



8

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

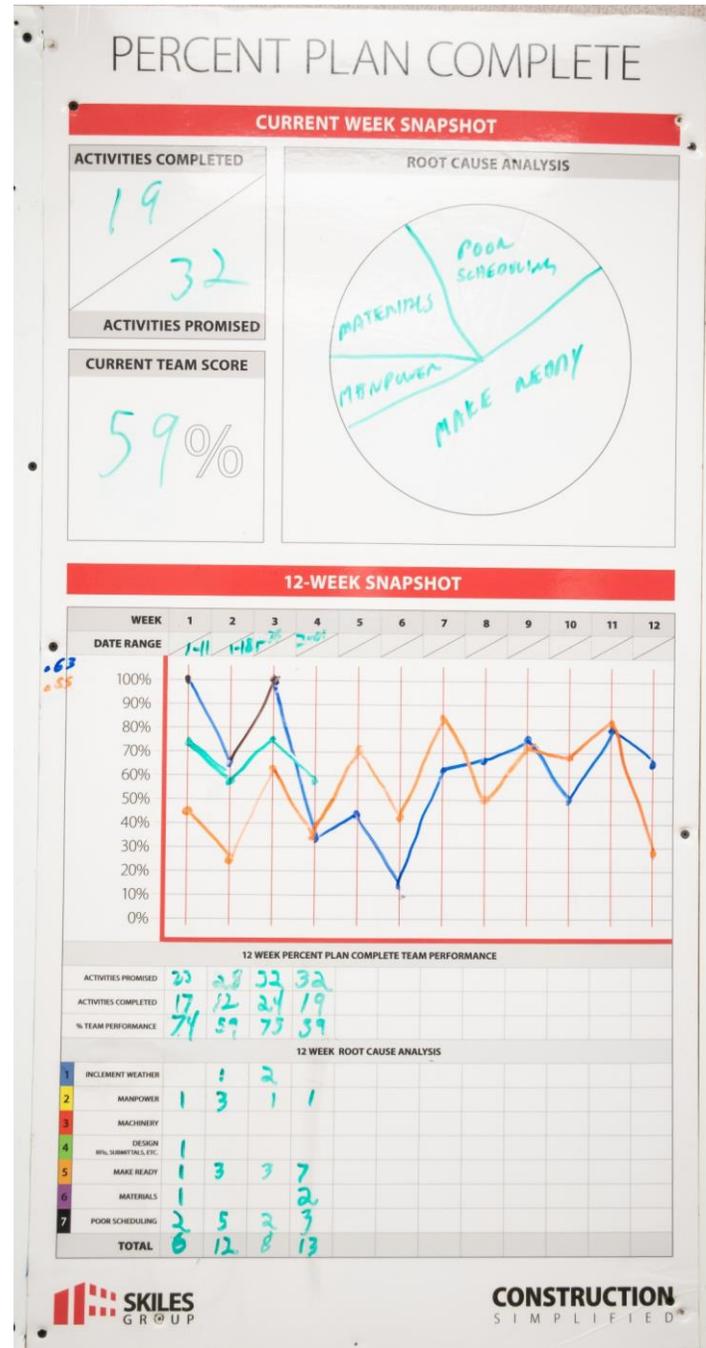
LAST PLANNER TRACKING

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8 Insulate AHU #7		SAFETY INSPECTIONS																												
9 Insulate AHU #9		SAFETY INSPECTIONS																												
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14 Sanitary waste vent Area A		SAFETY INSPECTIONS																												
15 Domestic water Area B north overhead		SAFETY INSPECTIONS																												
16 Domestic water IN-WALL Area C		SAFETY INSPECTIONS																												
17		SAFETY INSPECTIONS																												
18 wire pull MCC TO AHU's		SAFETY INSPECTIONS																												
19 Wire pull MCC TO CUP		SAFETY INSPECTIONS																												
20 Overhead Rough AHU 7,8,9 (Main Rack)		SAFETY INSPECTIONS																												
21 Penthouse Elec Room Rough		SAFETY INSPECTIONS																												
22 AHU 7 Rough		SAFETY INSPECTIONS																												
23 AHU 8 Rough		SAFETY INSPECTIONS																												
24 AHU 9 Rough		SAFETY INSPECTIONS																												
25 Area B Rack (N) overhead Rough		SAFETY INSPECTIONS																												

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	Week 2	Week 3	Week 4	Week 5	Week 6
	3/23	8/30	9/6			
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%			

▲

Root Cause Analysis: % of Promised Items Not Completed
For the week of:

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