

24TH ANNUAL



24TH LCI CONGRESS
OCTOBER 18-21

7 Years of Lean: A Retrospective on the Penn Pavilion's Lean journey

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LEAN GUMBO: THE RIGHT INGREDIENTS FOR PROJECT SUCCESS

OCTOBER 20, 2022

SIX TENETS OF LEAN CONSTRUCTION

- 1 Respect for People
- 2 Optimize the Whole
- 3 Generate Value
- 4 Eliminate Waste
- 5 Focus on Flow
- 6 Continuous Improvement



Continuous Improvement

Lean thinking demands a mindset of continuous improvement.

This requires an environment where we can discuss what's not working well and find fixes.



Looking Back



Problem Statement

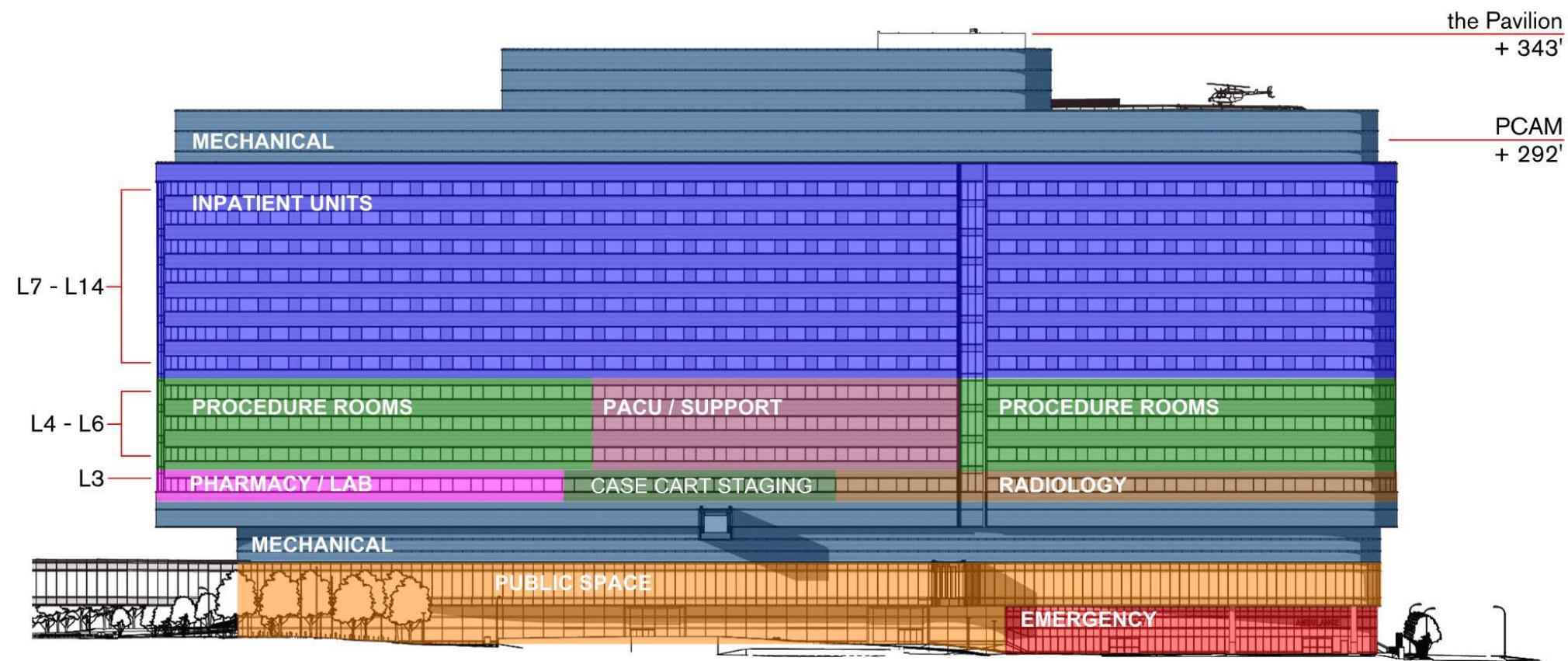
- Looking back on 7 years of experiences, lessons, and improvements to identify best practices to carry forward and watch-outs to avoid on future projects.

Seven years of stories

Program

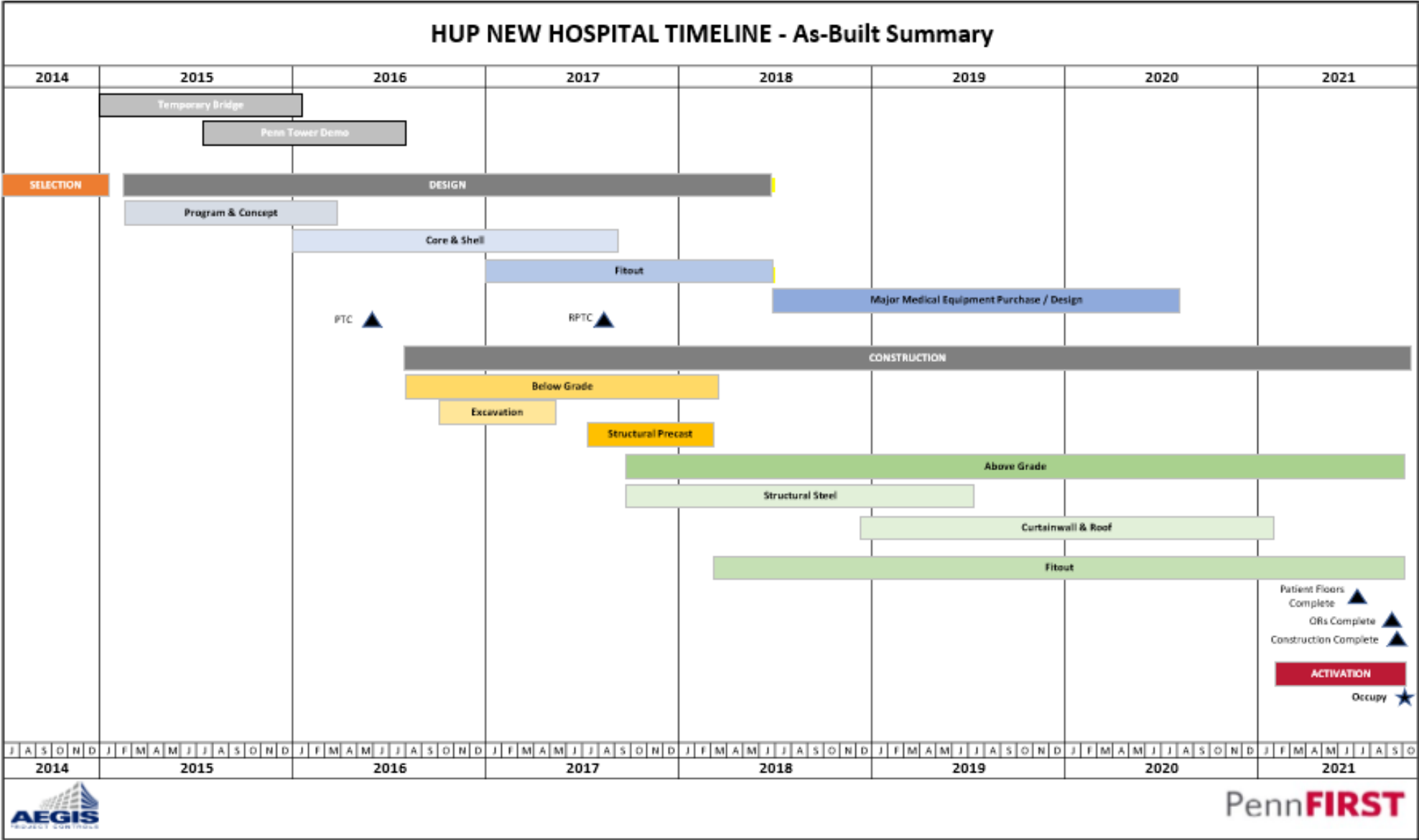
Sectional Diagram

- 1.5MSF
- 500 Patient Rooms
- 47 Operating & Procedure Rooms
- 61 ED Rooms
- 690 Parking Spaces

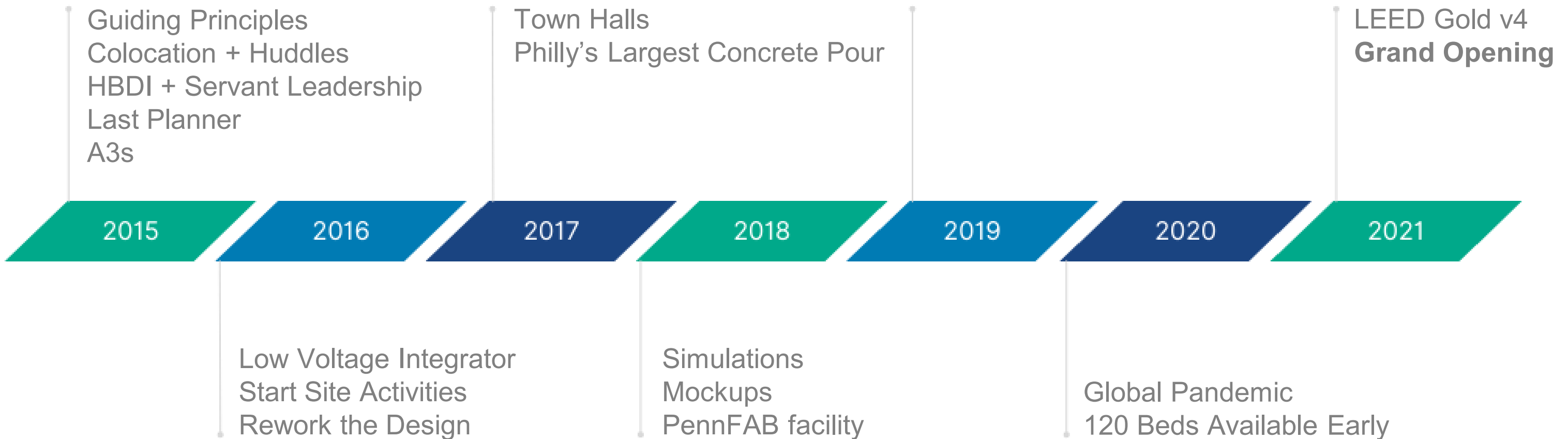


Seven years of stories

Project Schedule



Seven years of stories



Six Key Areas



Colocation
and
Huddles



Target
Value
Design



Key Trade
Partners



Continuous
Onboarding



PennFAB



Lean Into
the Field

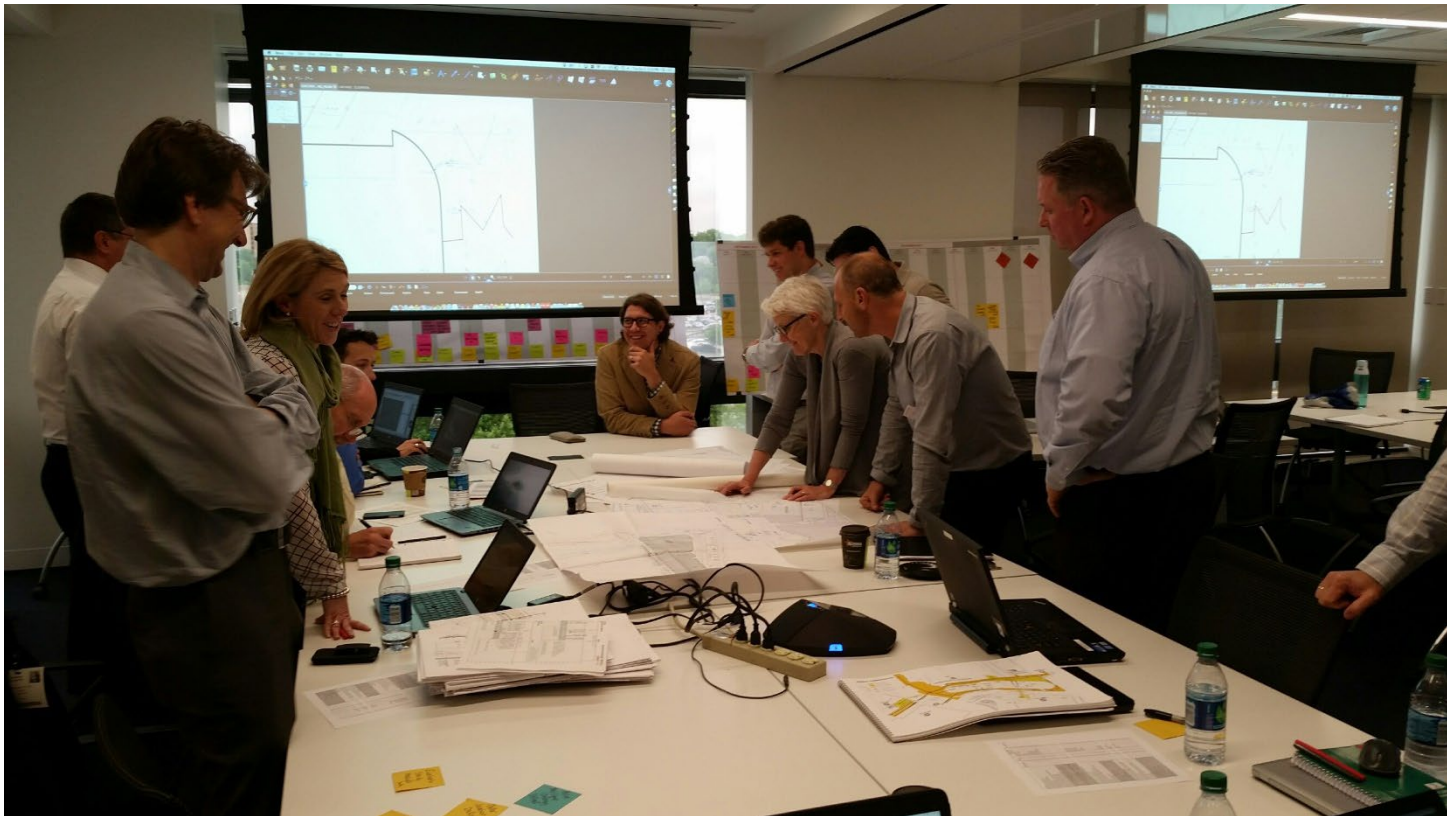
Colocation and Huddles



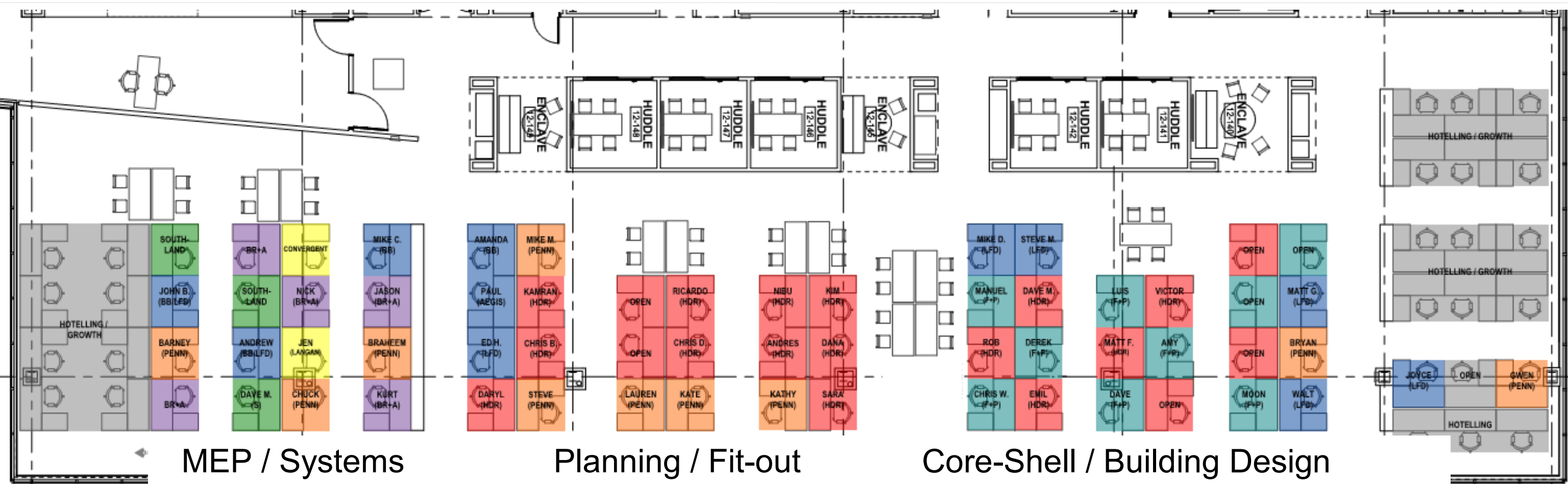
Colocation and Huddles



Colocation and Huddles



Colocation and Huddles



Penn

JV

HDR

F+
P

BR+A

Langan

Southland

Colocation and Huddles

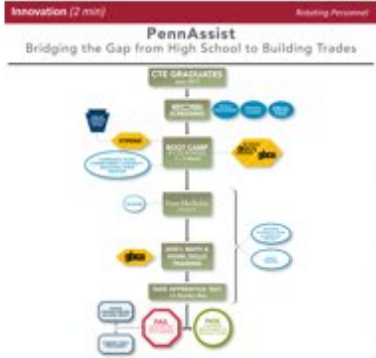
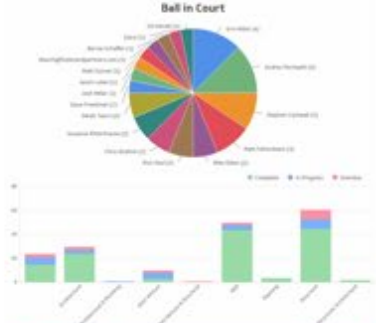


Colocation and Huddles

Team Huddle 2.0

PennFIRST

- 1. New Faces | A/IOTW
 - 2. Construction Update
 - 3. Schedule | Milestones
 - 4. Project Metrics
 - 5. Design Update
 - 6. Cost & Procurement Update
 - 7. Sustainability
 - 8. Innovation
 - 9. A3's
 - 10. Safety
 - 11. COLO News
- ***BREAK***



Safety (3 min) John McCoach | Andrea Klein

PennFIRST Safety

PennFIRST - Job Site Dashboard

"Do your work with pride, put safety in every stride..."

Observation Severity Level

28.57% Low, 71.43% Medium

7 Day Scoreboard

Most Non-Comp Sub-Categories	Most Hazardous Categories
Guardrail System 1	Concrete/Masonry 0
Use Of PPE/Not Pe... 1	Cranes And Hoistin... 0
Slip, trip, fall h... 1	Electrical 0
Defective/Damaged ... 1	Excavations 0
Gloves 1	Fall Protection 0

(Improved by 1.4%) (0 High/Hazardous Items this week)

Inspections	Observations	Non-Compliant Conditions
32	3643	263

(6.8% of all observations are Non-Compliant)



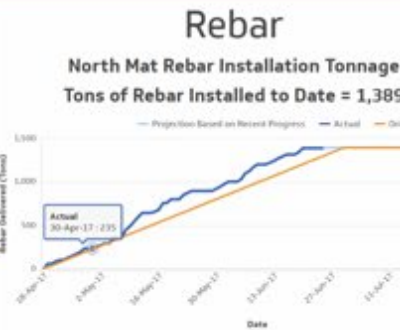
PennFIRST

- 1. New Faces | A/IOTW
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- ***BREAK***



Construction Update (3 min)

- North:**
- Madison Concrete installing rebar for the north mat slab.
 - 7/8/17 Main Mat Pour
 - Thomas waterproofing foundation walls
- South:**
- Excavating for footings.
 - Hauling footing excavation spoils.
 - Placing concrete mud mat
- Information Needed:**
- Rock Anchor Details (See RFI)
- Steel:**
- Resolving all open (bubbled) areas on Mill Order Drawings



Colocation and Huddles

Penn**FIRST**

WEEK 'C'

Introduction

Garage

- Safety
- Logistics
- Procurement
- Schedule
- Design
- Controls

Podium

Perimeter

Project News

BREAK!

Area Team Update: Garage

Area PM

PECO Gear Set Beams Above Installed

PECO/Fuel Tank Metal Deck Installed

PECO/Fuel Tank Rebar Installed

Logistics

Area Superintendent & Area PM

OSM: HEADWALLS

- 57 total ED Headwalls
- "First In Place" Installed
- Remaining 56 headwalls scheduled for 3/25 delivery

Design

Project Architect

Emergency Department Leave Outs

ISSUE 47: - ADDED (2) BEHAVIORAL HEALTH EXAM ROOMS - ED276 & ED286
- ADDED PATIENT BELONGING LOCKERS AT RADIOLOGY ALCOVE ED339
- REVISED ED INTERNAL WAITING - FURNITURE LAYOUT, ADDED SINK AND OMNICELL. SHIFTED POC ALCOVE AND CHANGED THE TOILET ACCESS TO INTERNAL WAITING. ADDED DOOR TO CONSULT ROOM.
- RAISED ALL EXAM ROOM DOOR HEIGHTS TO 7'-4"
- LOWERED CROSS-CORRIDOR DOORS TO 7'-0" ON ED FLOOR
- LOWERED CEILING HEIGHTS TO 8'-0" ON ED MEZZ

ISSUE 49: - PARTITION MODIFIER BETWEEN EXAM ROOMS
- POSSIBLE WINDOW TREATMENT ISSUANCE
- ICE MACHINE - SINK MODIFICATION

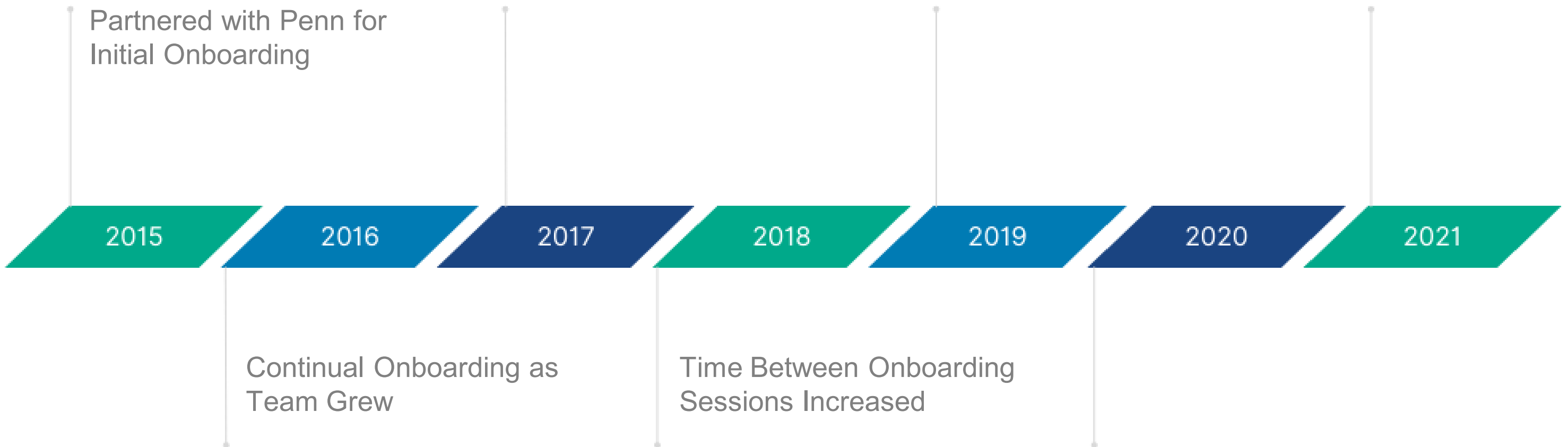
ED Mezz Leave Outs - Area 3



Continuous Onboarding



Continuous Onboarding

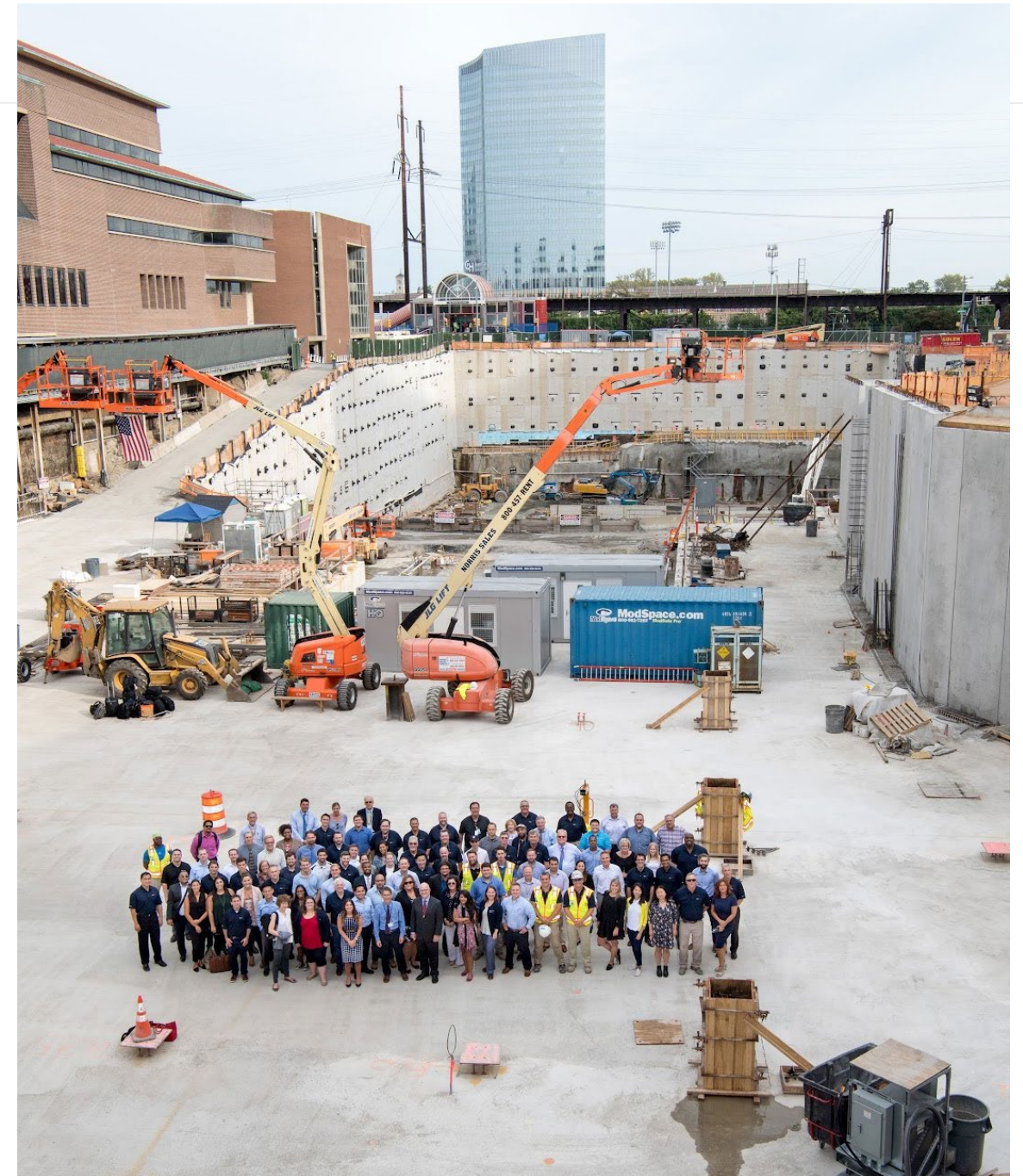


Continuous Onboarding

- Intro to Penn Medicine
- Project Overview
- PennFIRST
- Integrated Project Delivery
- Project Status and Schedule
- PennFIRST Covenant
- Strengths Finder
- HBDI and Servant Leadership
- Compelling Videos from Leadership
- Tools & Processes Overview



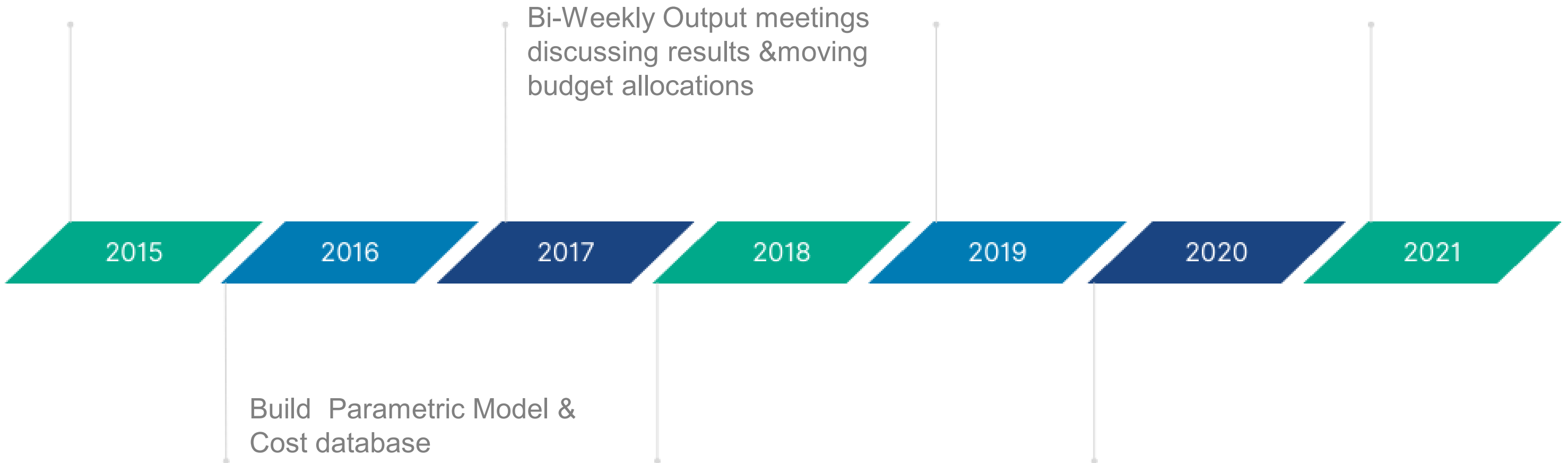
Continuous Onboarding



Target Value Design & Risk and Opportunities



Target Value Design & Risk and Opportunities



Target Value Design & Risk and Opportunities



Integrated Design & Estimating -TVD



		Fit Out Costs															
Room Type:	Description:	Ceiling Finish		Wall Finish		Floor Finish		Base Finish		Lighting		Interior Glass	Total	Doors	Casework	Specialties	Total
A4	Private Offices/ Private Huddle	Mineral Fiber ACT	\$10.50	Paint, Eggshell Finish; provide glazed fronts and doors	\$0.00	Carpet Tile	\$10.00	4" High Resilient, Cove Style	\$1.00	\$7.83	\$0.00	\$29.33		\$4,000.00	\$0.00	\$0.00	\$4,000
		BOD: Armstrong Dase, Tegular, 15/16" Grid	/SF	BOD: PPG or equal	/SF	Allow: \$45/SY	/SF	BOD: Johasoaite or equal	/SF	/SF	/SF	/SF	/SF	/Instance	/Instance	/Instance	/Instance
A5	Open-Office Area	Mineral Fiber ACT, allow for multiple heights and indirect lighting	\$12.00	Paint, Eggshell Finish	\$0.00	Carpet Tile	\$10.00	4" High Resilient, Cove Style	\$0.50	\$13.36	\$0.00	\$35.86		\$0.00	\$10,000.00	\$0.00	\$10,000
		BOD: Armstrong Dase, Tegular, 15/16" Grid	/SF	BOD: PPG or equal	/SF	Allow: \$45/SY	/SF	BOD: Johasoaite or equal	/SF	/SF	/SF	/SF	/SF	/Instance	/Instance	/Instance	/Instance
A6	Conference Rooms	Mineral Fiber ACT, drywall accents	\$15.00	Paint, Eggshell Finish	\$0.00	Carpet Tile	\$10.00	4" High Resilient, Cove Style	\$1.00	\$16.54	\$50.00	\$92.54		\$8,000.00	\$0.00	\$0.00	\$8,000
		BOD: Armstrong Dase, Tegular, 15/16" Grid	/SF	BOD: PPG or equal	/SF	Allow: \$45/SY	/SF	BOD: Johasoaite or equal	/SF	/SF	/SF	/SF	/SF	/Instance	/Instance	/Instance	/Instance
A7	Break Room	Mineral Fiber ACT, drywall accents	\$15.00	Paint, Eggshell Finish	\$0.00	LVT	\$10.00	4" High Resilient, Cove Style	\$1.00	\$7.32	\$50.00	\$83.32		\$4,000.00	\$8,000.00	\$0.00	\$12,000
		BOD: Armstrong Dase, Tegular, 15/16" Grid	/SF	BOD: PPG or equal	/SF	BOD: Johasoaite or equal	/SF	/SF	/SF	/SF	/SF	/SF	/SF	/Instance	/Instance	/Instance	/Instance
BS1	Building Support Space: Stairs	None	\$0.00	Paint, Eggshell Finish	\$0.00	Handings: LVT stair; pre-fab metal	\$10.00	4" High Resilient, Cove Style	\$1.00	\$3.75	\$0.00	\$14.75		\$2,500.00	\$0.00	\$0.00	\$2,500
		BOD: N/A	/SF	BOD: PPG or equal	/SF	BOD: Mokawb, Bolder	/SF	BOD: Johasoaite or equal	/SF	/SF	/SF	/SF	/SF	/Instance	/Instance	/Instance	/Instance
BS2	Building Support Space: TDR Rooms	None	\$0.00	Fire rated plywood panels	\$50.00	Sealed concrete	\$1.00	4" High Resilient, Cove Style	\$1.00	\$3.15	\$0.00	\$55.15		\$1,800.00	\$0.00	\$0.00	\$1,800
		BOD: N/A	/SF	BOD: N/A	/SF	BOD: N/A	/SF	BOD: Johasoaite or equal	/SF	/SF	/SF	/SF	/SF	/Instance	/Instance	/Instance	/Instance
BS3	Building Support Space: Electrical / Mechanical Rooms	None	\$0.00	Paint, Eggshell Finish	\$0.00	Sealed Concrete, Specify waterproofing on floors, especially around floor drains	\$10.00	4" High Resilient, Cove Style	\$1.00	\$4.55	\$0.00	\$15.55		\$1,800.00	\$0.00	\$0.00	\$1,800
		BOD: N/A	/SF	BOD: PPG or equal	/SF	BOD: N/A	/SF	BOD: Johasoaite or equal	/SF	/SF	/SF	/SF	/SF	/Instance	/Instance	/Instance	/Instance
C9	Circulation	Mineral Fiber ACT, allow for multiple heights and indirect lighting	\$12.00	Paint, Eggshell Finish	\$0.00	Carpet Tile	\$10.00	4" High Resilient, Cove Style	\$0.50	\$13.36	\$0.00	\$35.86		\$0.00	\$0.00	\$0.00	\$0
		BOD: Armstrong Dase, Tegular, 15/16" Grid	/SF	BOD: PPG or equal	/SF	Allow: \$45/SY	/SF	BOD: Johasoaite or equal	/SF	/SF	/SF	/SF	/SF	/Instance	/Instance	/Instance	/Instance
F3	Family/Visitor Space/ Reception/Elev Lobby	Mineral Fiber ACT, drywall accents	\$15.00	Paint, decorative panel accents on (1) wall	\$20.00	Carpet Tile	\$10.00	4" High Resilient, Cove Style	\$0.50	\$13.64	\$0.00	\$59.14		\$8,000.00	\$15,000.00	\$0.00	\$23,000
		BOD: Armstrong Dase, Tegular, 15/16" Grid	/SF	BOD: PPG Paint, allow \$30/SF for decorative panels	/SF	Allow: \$45/SY	/SF	BOD: Johasoaite or equal	/SF	/SF	/SF	/SF	/SF	/Instance	/Instance	/Instance	/Instance
T2	Toilet Room: Single Use- Urinals (also multi-use)	Mineral Fiber ACT	\$12.00	Paint, Epoxy Finish, hygienic panel wainscot at wet wall	\$65.00	Slip resistant vinyl sheet	\$10.00	4" High Resilient, Cove Style	\$1.00	\$12.59	\$0.00	\$100.59		\$1,800.00	\$0.00	\$1,500.00	\$3,300
		BOD: Armstrong Dase, Tegular, 15/16" Grid	/SF	BOD: PPG Paint, Corian Grade D	/SF	BOD: Altro, Aquearis	/SF	BOD: Johasoaite or equal	/SF	/SF	/SF	/SF	/SF	/Instance	/Instance	/Instance	/Instance



Risk & Opportunity (R&O)



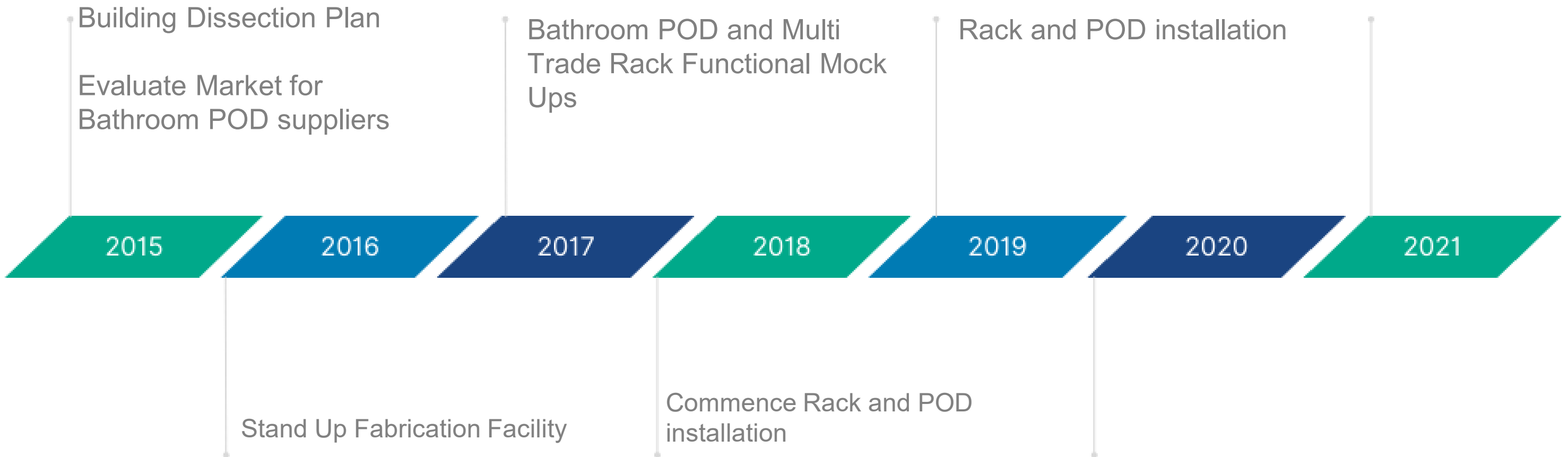
Risk & Opportunity (R&O)

Forms																	
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ID	Status	Category	Description	Ball in Court	A3 Requi...	PCI/Tracking #	Date Created	Est. Cost Impact	Action / Comment	Risks Included in Forecast	Decision Date	RPTC Funded	Risk Level	PennFIRST R/O	Owner R/O	Contingency Impact	Profit
			Committed Contingency in CMiC						Posted & Pending Transactions					\$2,571,176	0	\$12,368,440	
			Starting Contingency											12,368,440			
			R&O Summary							\$216,568				\$187,948	\$652,519	-\$9,797,264	
	Open	Carpentry (Above 7)	Phila D&M R&O Summary	Melograno					Forecast Log Projection Should Balance with Value in Adjacent Column	\$0				\$0	\$0	-\$10,191,532	
	Open	Carpentry (Below 7)	Dale R&O Summary	Yohe					Forecast Log Projection Should Balance with Value in Adjacent Column	-\$174,463				-\$1,095,099	\$881,026	-\$2,268,937	
	Open	JV	JV PR Buyout Summary	Guinan		JV PCI #			Value Indicates Sum of Buys	\$0				\$0	\$0	\$5,800,193	
	Open	JV	JV PR WNP Summary	Guinan		JV PCI #			Value Indicates Sum of Proposed WNPs	\$0				\$0	\$0	\$13,597,580	
	Open	Precast	Shockey R&O Summary	McCabe					Forecast Log Projection Should Balance with Value in Adjacent Column	\$0				\$0	\$0	-\$1,101,215	
	Open	Design Team	Design Team Summary	Bodewin					Summary	-\$184,695				-\$289,205	\$0	\$12,760,433	
	Open	Oliver	Oliver Sprinkler R&O Summary	Oliver					Forecast Log Projection Should Balance with Value in Adjacent Column	\$487				\$0	-\$266,601	-\$1,635,923	
	Closed	Oliver	Add Schedule 80 Pipe on inlet to firepumps and 25' downstream of pumps.	Greulich		CR0008	07/28/17	\$18,713	Owner Request (Dominic) outside of RPTC specifications. See attached Revised OSCO quote dated 1/17/18.	KTSA #07			Incurred (0%)		0		YES
	Closed	Oliver	Upturned heads in Materials Management	Moss		001	09/05/17	\$16,000	\$16K already included in OSCo KTS.				Void (0%)	\$0			
	Closed	Oliver	Added scope on FP Equipment Submittal Review	Oliver		IB0859	11/09/17	\$2,497	Misc Scope added by BR+A during Equipment submittal. As agreed upon by team at 12/21 RO meeting, this work is approved and shall proceed. No Profit.	KTSA#08	12/21/17		Incurred (0%)	\$0			
	Closed	Oliver	Preaction system @5th floor MRI not on FP design docs nor priced by OSCo.	Oliver		IB0879	01/16/18	\$16,885		KTSA#08	04/01/18		Incurred (0%)	\$0			
	Closed	Oliver	P2 Dry Pendant type heads in garage added due to no extended davits 2 locations- ~15 heads.	Oliver			01/16/18	\$9,387	1/16/18 See revised OSCO quote dated 1/16/18 with correct labor rates.	No			Void (0%)	\$0			
	Closed	Oliver	Preaction System@ CT Scan Room 136 in ED, not on FP Design docs nor originally priced by OSCo.	Oliver		IB0879	01/30/18	\$50,180		KTSA#08	02/07/18		Incurred (0%)	\$0			
	Closed	Oliver	Additional Heads- Public Areas	Oliver			02/15/18	\$20,250	Preliminary Sprinkler Head Coordination between F&P and Oliver is resulting in additional Heads counts. R Oliver to provide details and estimated costs. Move to TVD. Provide Layout to F&P for review. No Profit	No	02/23/18		Void (0%)	\$0			
	Closed	Oliver	Premium head counts for levels P-1, P-2 and Tunnel .	Oliver		IB1124	02/27/18	\$544,301	12/11/19 : updated costs includes overhead and profit. This item also now includes the 2 added dry systems in the garage (which is now voided on R/O).	KTSA #010			Incurred (0%)			-\$544,301	
	Closed	Oliver	2 add'l dry systems-garage	Oliver			03/15/18	\$93,920	This item is now being tracked as a part of the "Premium Head Counts for Levels P1, P2 & Tunnel R/O item.	No			Void (0%)	\$0			

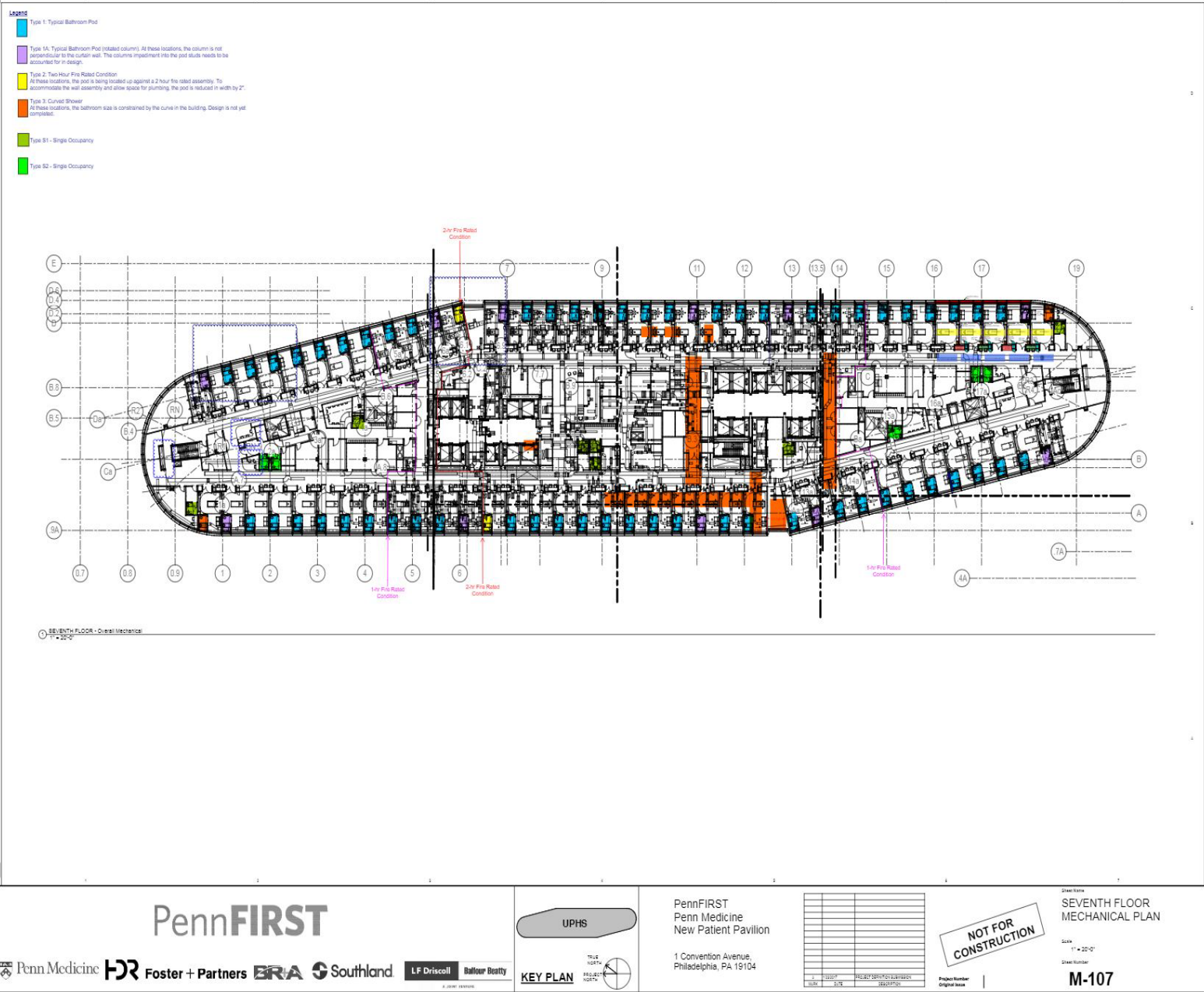
PennFAB: Off-Site Manufacturing



PennFAB: Off-Site Manufacturing



Off-Site Manufacturing



Off-Site Manufacturing



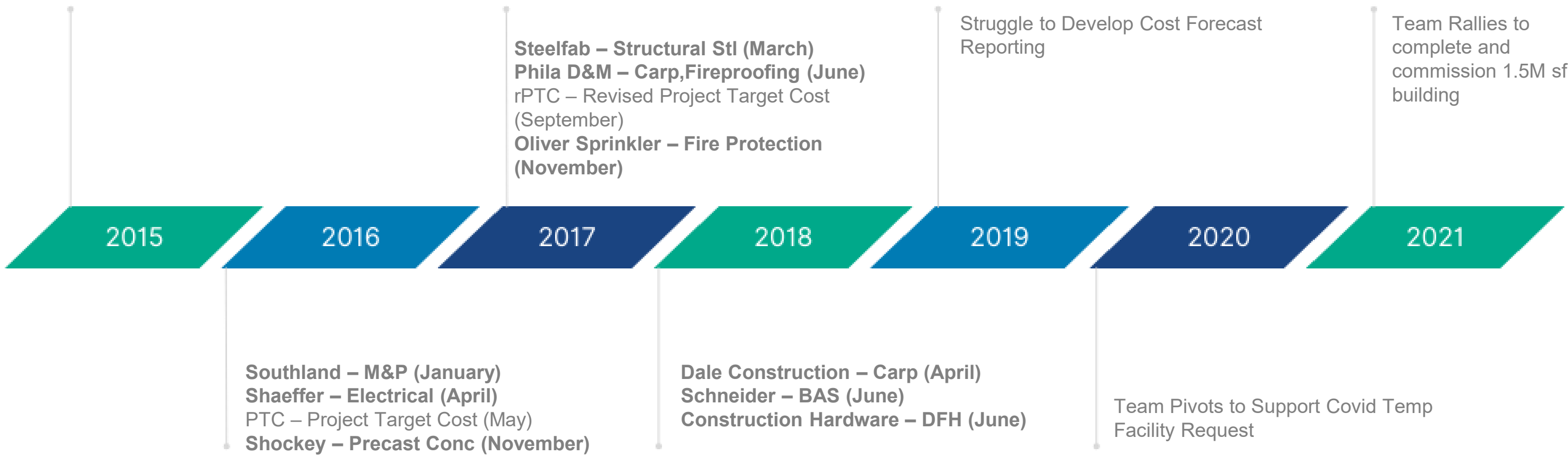
PennFAB: Off-Site Manufacturing



Key Trade Partners



Key Trade Partners



Key Trade Partners

- WHO....What trades do we want as Key Trade Partners?
- WHY...Why should they be a Key Trade Partner?
- WHEN...When do we bring them onto the team?
- WHAT...What do we want them to do when they join the team?
- HOW...How do we determine and define OH, Profit, Scope?



Key Trade Partners

Positives

- Budget and Schedule Development Support
- Pre-Fabrication and OSM
- Constructability Input During Design
- Design Support / BIM Modeling = Reduced redundant design
- More Efficient Management Team



Key Trade Partners

Challenges

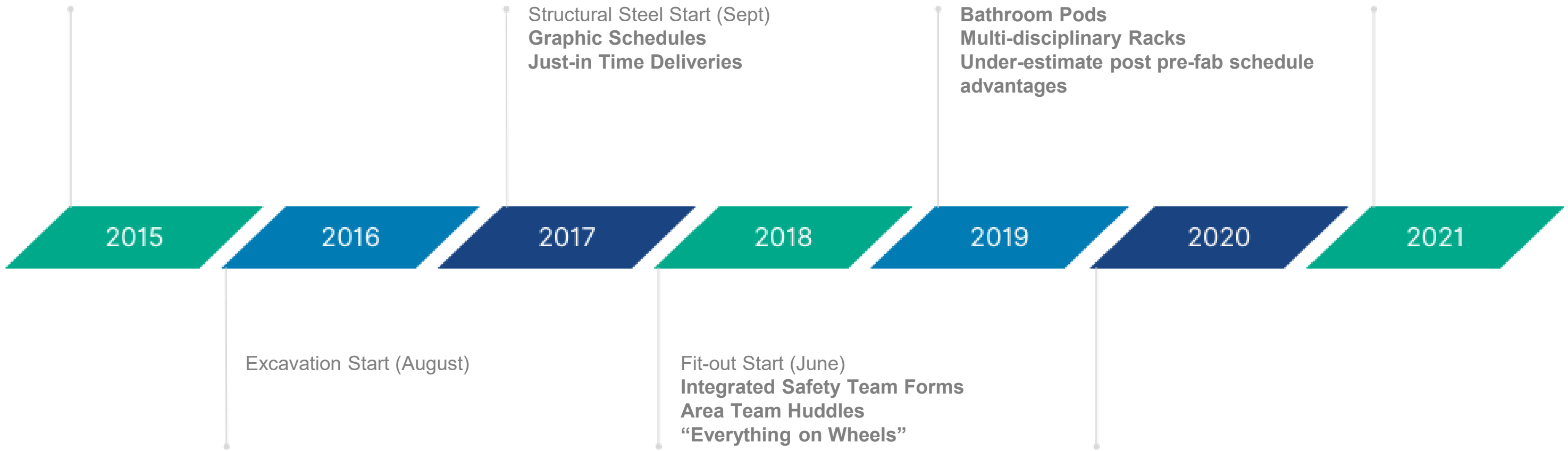
- Procurement
- Integration with Design Team
- Shifting Mindset from Traditional Thinking
- Cost Forecasting and Transparency



Lean Into the Field



Lean Into the Field



Lean Into the Field

Positives

- Area Team Concept During Execution
- Pull Planning – Trade Foreman more involved in planning
- Everything on Wheels – More efficient materials management
- Integrated Safety Team – Trades more involved in safety
- Pre-Fab and OSM – Cleaner and more efficient work space



Lean Into the Field

Challenges

- Construction transitions from prefab to stick built
- On-boarding of Sub-Contractors and Workforce
- Lean education of the Union Workforce
- Infusing collaborative behaviors on Union Workforce
- IPD business deal understanding of the Union Workforce



Taking the Lessons Forward



Would you do it again?



How can you apply this tomorrow?

- *Think of how you can use huddles and visual information to bring alignment across your team*
- *Organize your team to maximize collaboration – even if it's not Co-Location*
- *TVD- Start on a small scale identify a particular area /scope such as finishes and work the process as a team. At the very least it will build trust through transparency*
- *R & O – It's less about the tool and more about the mindset. All contracting parties must look at opportunity not just risk and how the benefit could be equitably shared*
- *OSM- You can never start early enough, create a dissection plan when competing, ensure that your supply chain and major trades are bought in.*
- *OSM- Look at the project holistically, evaluate overall value to the project not just first cost.*
- *Develop a plan for Key Trade Partner Procurement*
- *Develop a plan for continuous onboarding of the field workforce*
- *Find a way to infuse Lean Principles and Training on the workforce*

Q & A

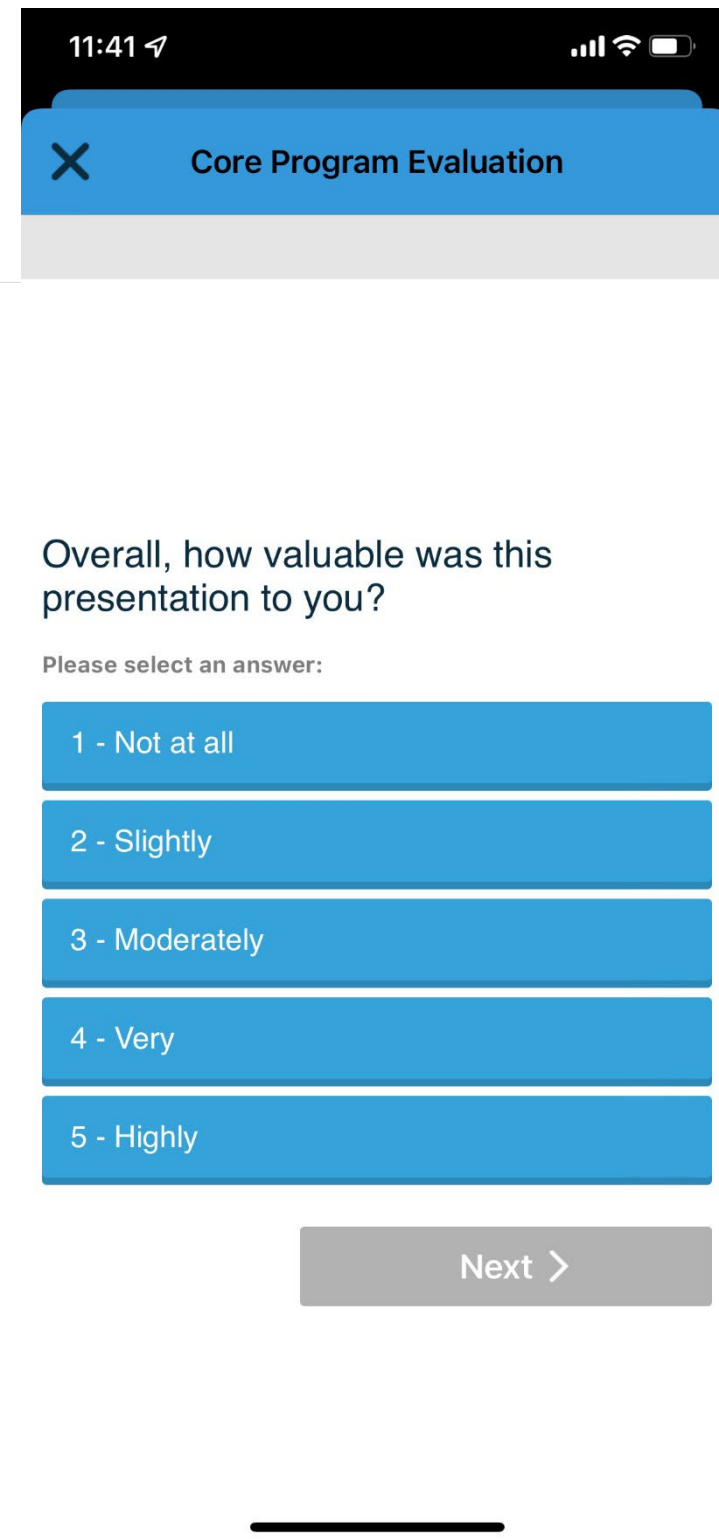
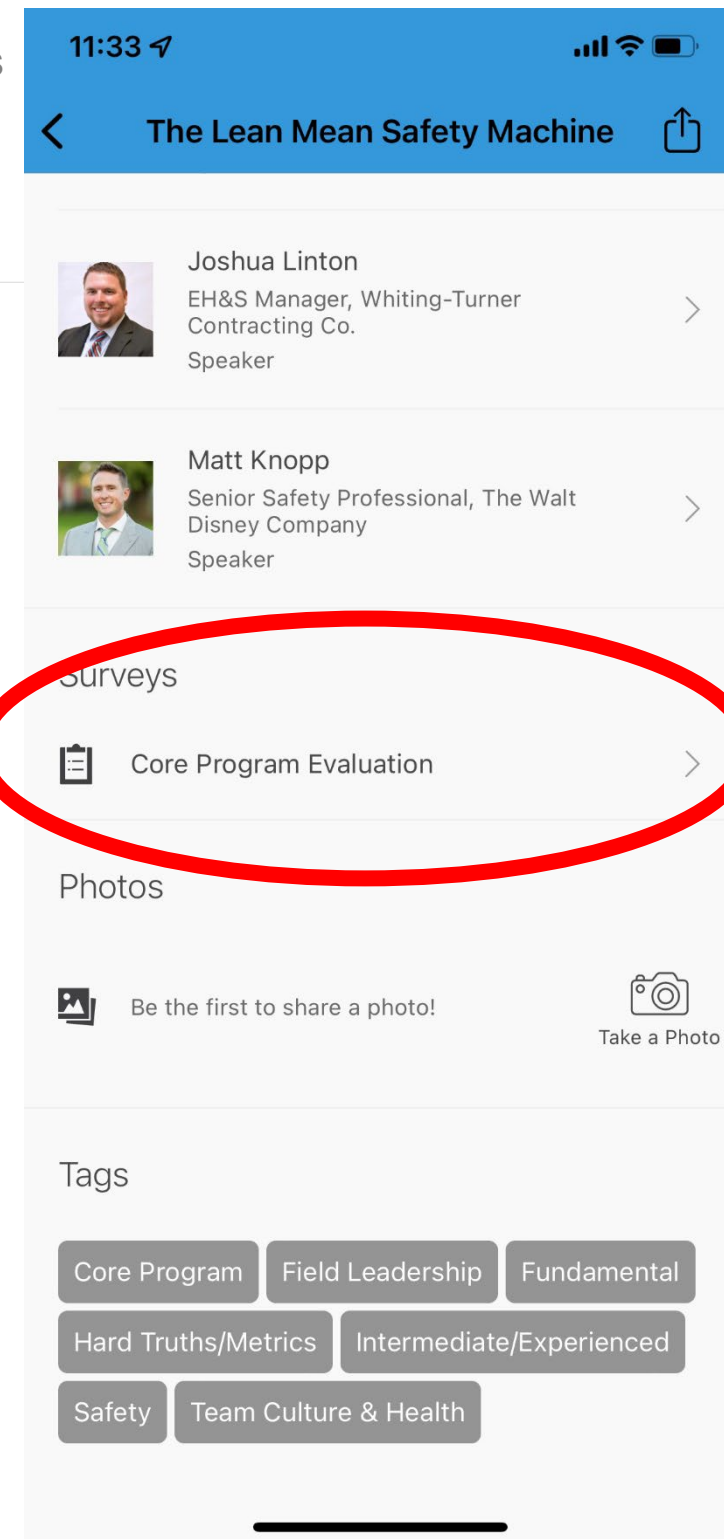


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Continuous improvement: give presenters your feedback by taking the session evaluation!

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





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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.



Contact Us

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

