

# LEAN ENGINEERING INTERNSHIP

Andres Ingram – Lean Engineer Intern

Continuous Improvement Team (CI Team)

5/20/2024 - 7/30/2024



# About me ©

- Born in Brownsville, Texas, USA
- Raised in Matamoros, Tamaulipas, Mexico
- University: UT Rio Grande Valley, Edinburg, Texas
- Major: B.S. in Manufacturing Engineering



# Kaizen Training Week @ Janesville, WI

#### What I learned

- Kaizen 10-Step Process
- Standard Work
- Cycle Time/Takt Time
- Work Balance
- -5S+1
- Push vs. Pull System
- Kanban
- Value Stream Mapping, etc.

#### What I did

- Lego Simulations
- Mini Kaizen Event
- Report Out to Plant Manager









# **Project Introduction**

### Project Background

- 90-Minute Overall Score On Time & Complete (OT&C) = 70.9%
- $OT&C = \frac{Deliveries Completed}{Total Deliveries Made}$
- OT&C = Common KPI metric across Masonite.

#### Problem Statement

- Inconsistent line throughput.
- Inconsistent employee productivity.
- Employee Work Content NOT Balanced
- Unbalanced production schedule.

### Project Goals

- OT&C ≥ 92%
- UPMH > 1.57



### **Project Methodology**

### Design & Approach

10 Step Kaizen Process

#### Materials & Tools Utilized

Excel, SWC, Time Observation Form, Pitch Chart, Leader Standard Work (LSW), etc.

#### Procedures Followed

Kaizen Event Training, Kaizen Event, Gemba Walks, 5S+1, Time Studies, Workload Studies, etc.

### Relevant Project Data Collected

- UPMH
- UPH
- Production
- Weekly Demand
- Production Schedule



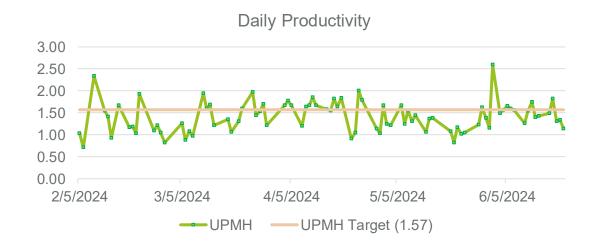
### **KPIs – Production & UPMH**

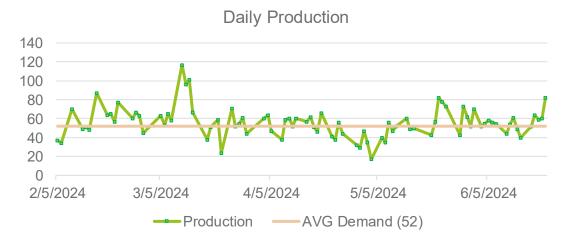
### UPMH – Productivity

- $\text{ UPMH} = \frac{\text{Production}}{\text{People} \times \text{Work Shift}}$
- Current (AVG) UPMH = 1.50
- High day to day inconsistency/variability to meet target.

#### Production

- Average Daily Demand (MP YTD Study) –
  52 Doors Per Day.
- High day to day production inconsistency/variability to meet customer demand.



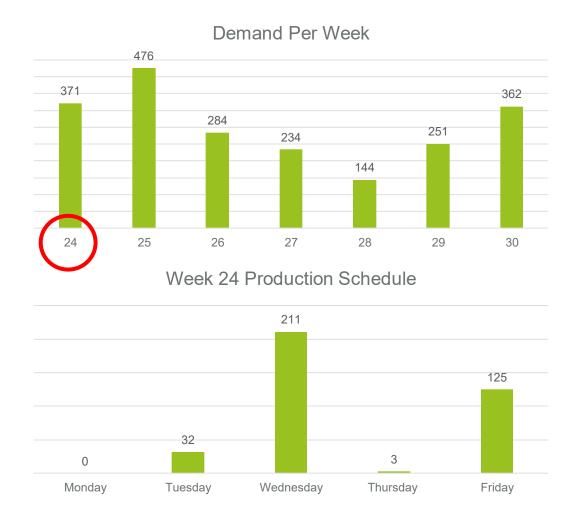




# Weekly Demand & Production Scheduling

 Demand Per Week data shows inconsistency/variability causing spikes in production and productivity.

 Weekly Production Schedule not leveled causing spikes in production and productivity.





# Kaizen Event Week @ DFC Dallas, TX

- Focus: 90-Minute FD Line
- Areas of Improvement
  - 1. Throughput
  - 2. Productivity
  - 3. Work Balance
  - 4. Production Schedule Balance.
- Team Members
  - Jeff
  - Chris
  - Karina
  - Joel
  - Josh
  - Aniket
  - John
  - Anthony
  - Joshua







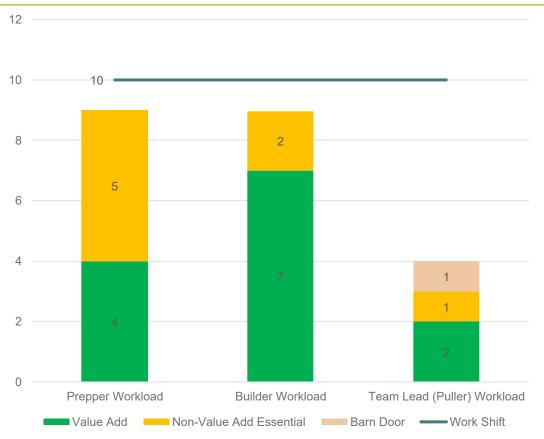


### Current Conditions – 10 Hour Schedule

### **Current State**

- Headcount = 3.5
  - Jeff (Prepper)
  - Tito (Builder)
  - Ruben (Builder)
  - Anthony (Team Lead 0.5)
- Work Shift = 10 Hours
- Average Daily Demand = 52 Doors/Day
- Average Throughput = 56 Doors/Day
- Average UPH = 5.6
- Average UPMH = 1.50

### Workload Analysis (Not Balanced)





# Kaizen Implementation 1 – Scheduling Board & Employee Training





# Kaizen Implementation 1 – Scheduling Board

#### Importance

Levels Demand throughout the week.

#### Purpose

- Distribute Tickets throughout the week.
- Standardize weekly duties for 90-Minute Crew.
- Standardize work activities

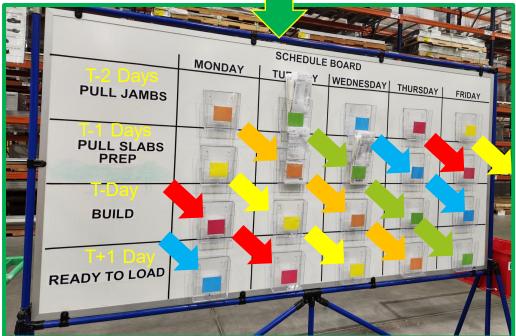
#### Process

- Ticket once finished (according to task), move ticket diagonally following its color onto the next day:
- T-2 Days = Pull Jambs by Prepper
- T-1 Days = Pull Slabs & Prep Jambs by Lead & Prepper.
- T-Day = Build Door by Builders
- T+1 = Doors Ready to Load

#### Improvement

- Before: No Visual Management tool for production balancing and demand balancing, Prepped Ticket Bin.
- After: Visual Management tool for production balancing and demand balancing, Scheduling Board.







### Kaizen Implementation 2 – 5S+1

#### Before

- Prepper Risk Injury
  - Prepper carrying jambs over to build line.
  - Not having jambs ready/staged prior build date
- High changeover time
  - Possible forklift accident
  - Blocking the pathway of the forklift
  - Not having slabs ready/staged prior build date

#### After

- Zero prepper risk injury
- No pathway blocking for forklift
- Staging area for jambs and slabs
- Staging areas supports the scheduling board
- Material ready prior Build Date



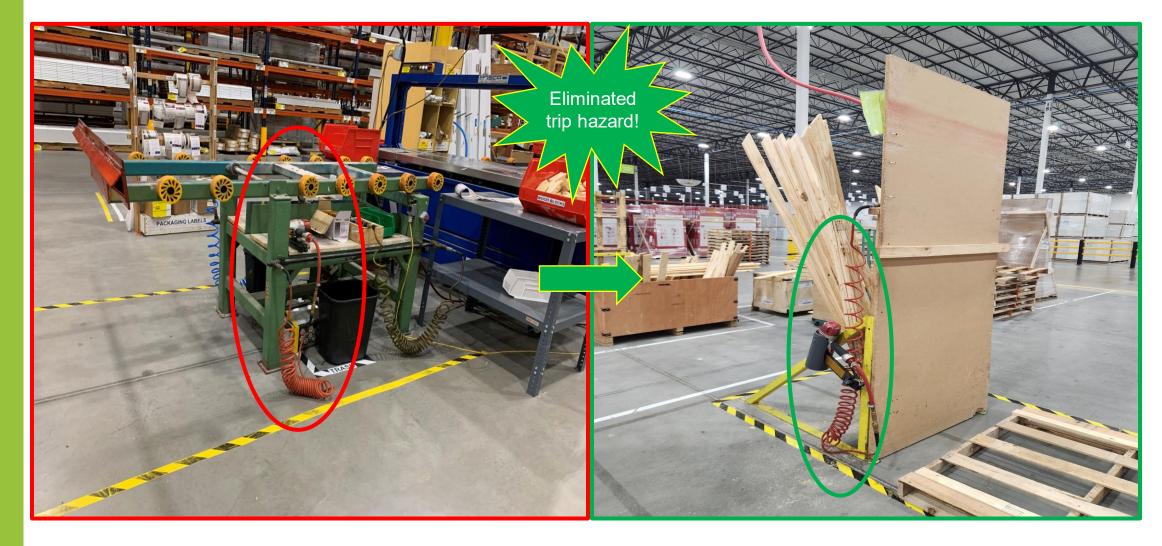






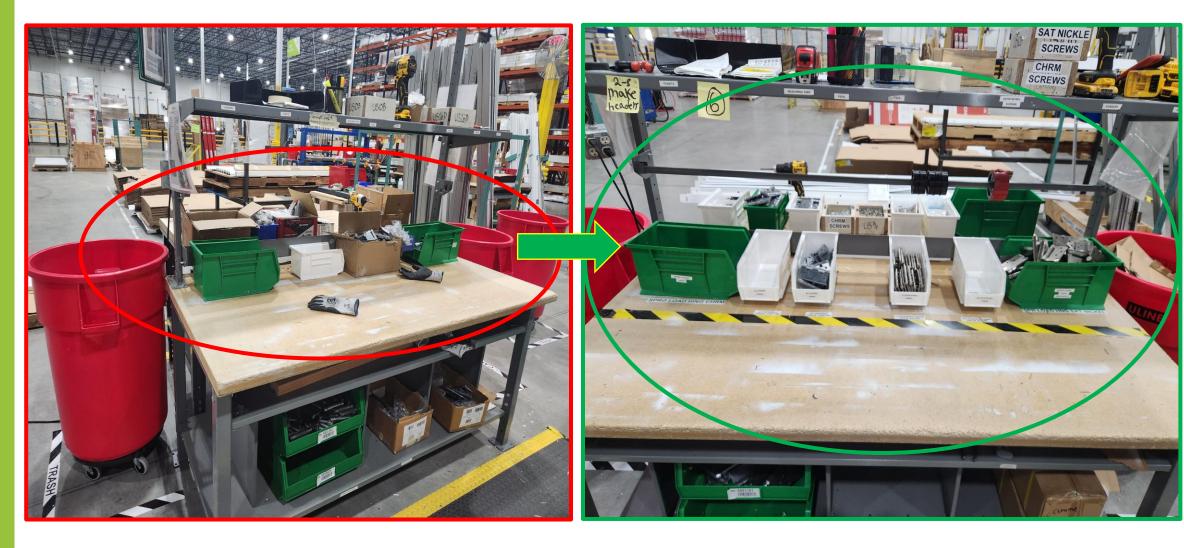


# Kaizen Implementation 2 – 5S+1



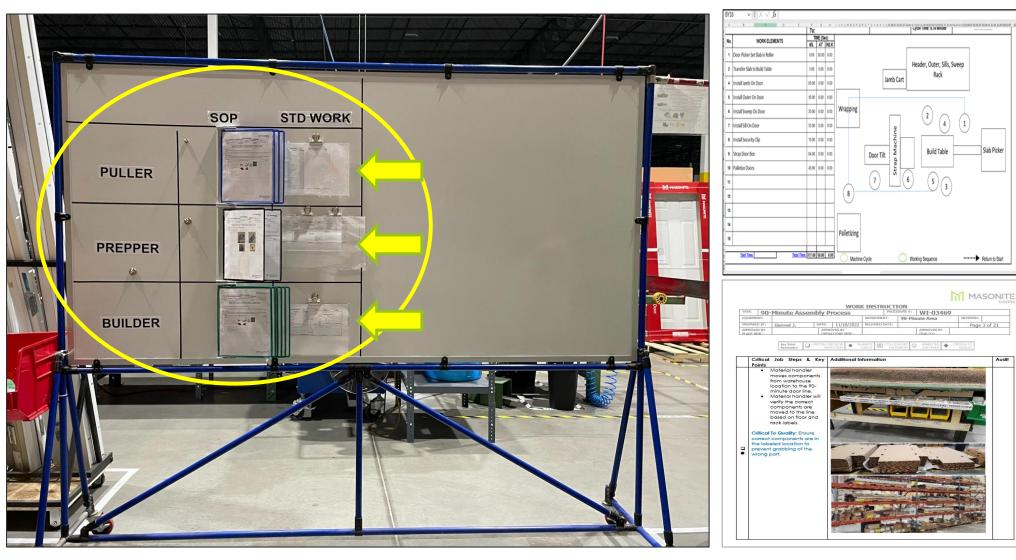


# Kaizen Implementation 2 – 5S+1





# Kaizen Implementation 3 – Standard Work & SOPs





Masonite Proprietary and Confidential

15

### Kaizen Implementation 3 – Standard Work & SOPs

### **Current State**

#### Before

- Headcount = 3.5
- 10 Hour Work Shift
- Average Throughput = <u>56 Doors/Day</u>
- Average UPH = 5.6 UPH
- Average UPMH = 1.50
- Production Line NOT Balanced

#### After

- Headcount = 3.5
- 10 Hour Work Shift
- Average Throughput = 62 Doors/Day
- Average UPH = 6.2 UPH
- Average UPMH = 1.77
- Production Line Balanced

%Improvement Throughput = 10.71% Improvement

%Improvement UPMH = 18% Improvement

### Workload Analysis (Balanced)



16



# Kaizen Implementation 4 – Leader Standard Work (LSW)

Importance

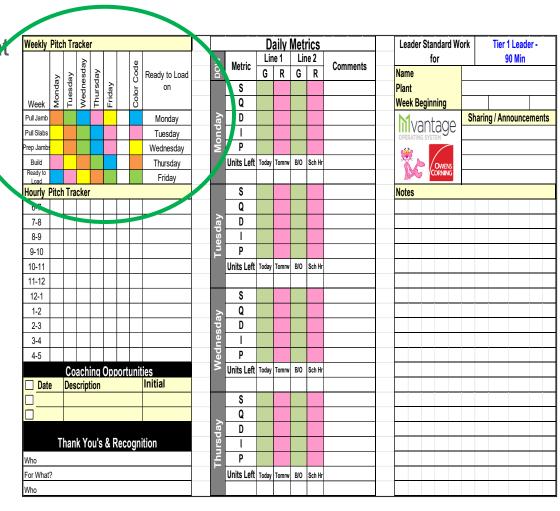
Sets daily standard tasks for continuous improvement

Purpose

Accountability and Responsibility for Team Lead.

Before

- No Leader Standard Work (LSW)
- No standard routine for Team Lead
- After
  - Tailored LSW for 90-Minute Team Lead.
  - Standard routine for Team Lead
  - Includes new implementation Sched. Board.





# Results

KPIs	Before Internship	After Internship	%Improvement		
Units Per Hour (UPH)	5.6	6.2	10.71%		
Units Per Man Hour (UPMH)	1.50	1.77	18%		
Overall Score – On Time & Complete (OT&C)	73.9%	81.6%	10.41%		
5S+1 Score	23	27	17.39%		



# Special Thanks To DFC Team ©

Tito

Joel

John

Jeff

Valentin

Gloria

Ruben

Jonathan

Aniket

Cheryl

Karina

Ed

Willy

Josh

Bryan

Glenn

Paul

Andrew

Todd

Ryan

Sergio

Anthony

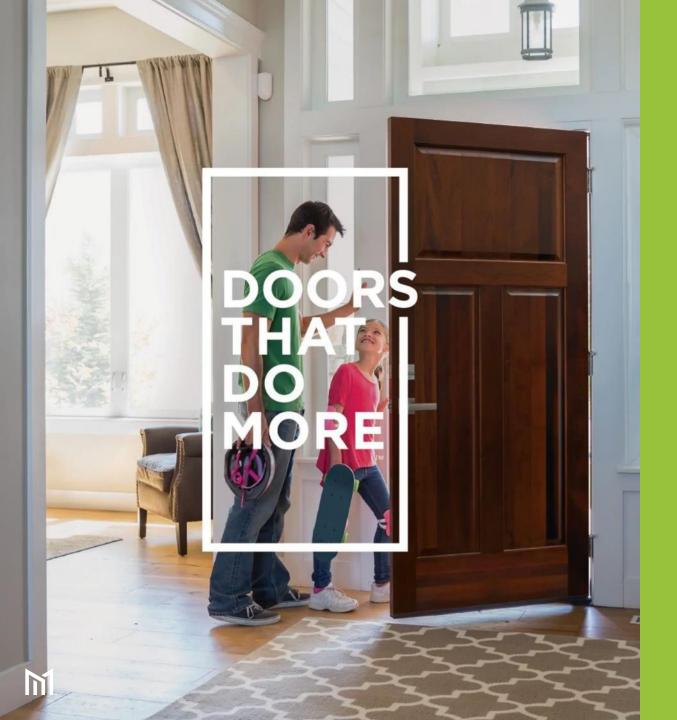
Britney

Chris

Pam

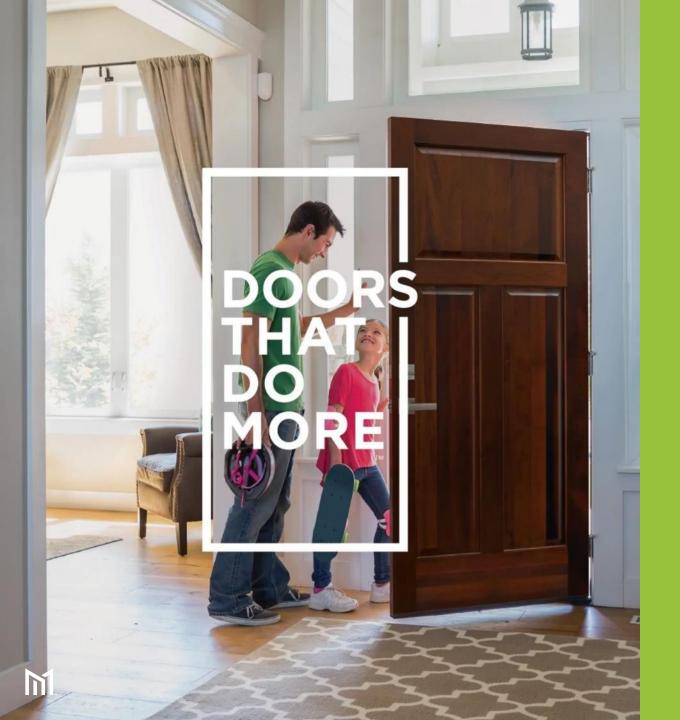
Victor

Daron

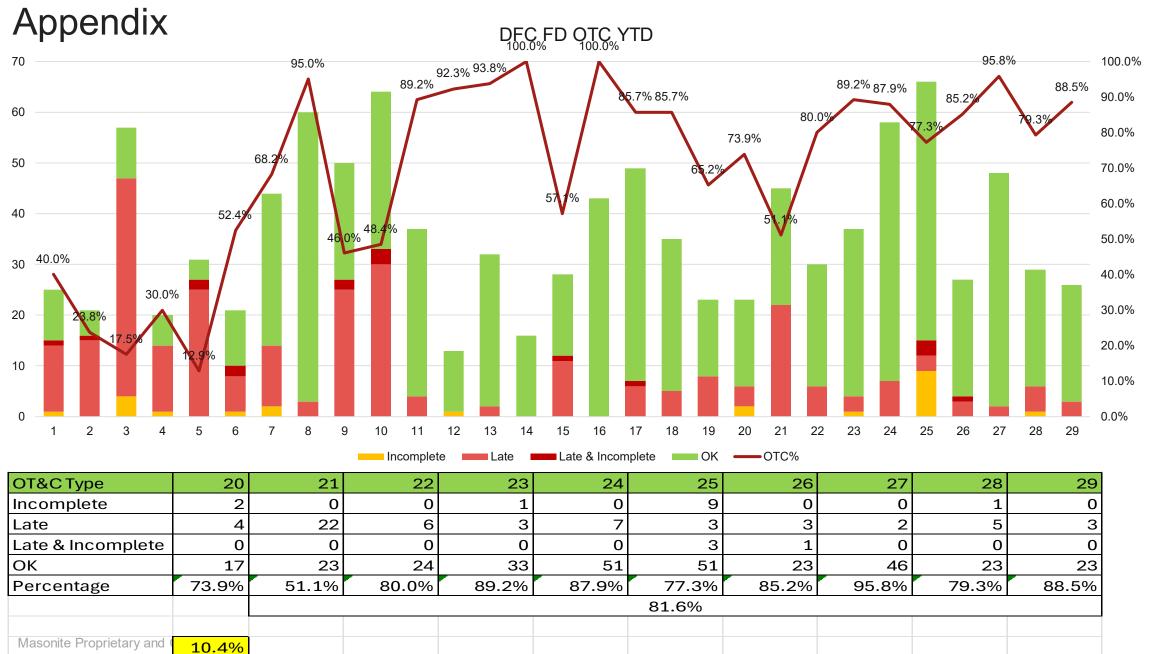


# Thank You!

**Questions?** 



# **Appendix**



# Workload Analysis (Daily Activities)

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A	В	С	D	Е	F	G	Н	I J
1 Line	Task (Pulling)	Travel Time (min) ▼	Frequency	Frequency (Ratio)	Pulling Time (min)	Quantity 🔻	Unit of Quantity	Workload (min)
37 Fire Door	Jamb Stock	5	Everyday		1 2	1	Pallet	7
38 Fire Door	Jamb Special	5	Everyday	1	2	1	Pallet	7
39 Fire Door	Sill Stock	10	Everyday	1	0.5	46	Units	33
40 Fire Door	Sill Special	5	Everyday	1	4	1	Pallet	9
41 Fire Door	Sweep	5	Everyday	1	0.5	23	Units	17
42 Fire Door	Outer Stock	5	Everyday	1	4	1	Pallet	9
43 Fire Door	Outer Special	5	Everyday	1	3	1	Pallet	8
44 Fire Door	Replenishing Wood	5	Everyday	1	0.5	46	Units	28
45 Fire Door	Slab Pyramid	2	Everyday	1	0.05	504	Units	28
46 Fire Door	Pallets	10	Everyday	1	35	3	Pallet	115
47 Fire Door	Hinge	2	Everyday	1	3	3	Pallet	11
48 Fire Door	Patina Screws (From Receiving)	2	3/Week	3/7	3	1	Box	3
49 Fire Door	Wood Blocks (come from receiving)	10	1/Two Month	1/60	0 10	1	Box	1
50 Fire Door	Door Packaging (cardboard)	C	1/Two Month	1/60	0	1	Box	0
51 Fire Door	Security Clip Screws (comes from receiving)	5	1/Two Week	1/14	4 5	3	Pallet	2
52 Fire Door	Deadlock plate screws (come from receiving)	C	1/Month	1/30	0	1	Box	0
	Header screws (come from receiving)	C	1/Month	1/30	0	1	Box	0
54 Fire Door	Black Pittsburg Screws	C	1/Month	1/30	0	1	Box	0
55 Fire Door	Brown Box Staples	10	1/Month	1/30	0 5	1	Box	1
56 Fire Door	Sill Screws	10	1/Month	1/30	0 3	1	Box	1
57 Fire Door	Deadplate	10	1/Month	1/30	0 3	1	Box	1
58 Fire Door	•		1/Week	1/7		1	Вох	2
	Sat. Nickel Screw (Builder & Prep)	5	1/Week	1/7	4	1	Box	2
60 Fire Door	Palletizing Staples	4	3/Week	3/7	10	1	Box	6
61 Fire Door	Strap Roll	10	2/Month	1/1	٦ ٦	1	Roy	1



# Before Implementation

- Before Implementations
  - 10 Hour Work Shift
  - Headcount = 3.5 People
  - AVG Production = 56 Doors
  - AVG UPH = 5.6 Doors
  - AVG UPMH = 1.52

4	A		В		С		D		Е		F
1	Date	•	Production	•	People	Ţ	Work Shift	Ţ	UPMH	*	UPMH Target
69	5/28/20	24		43		3.5		10	1.	23	1.57
74	6/3/20	24		52		3.5		10	1.	49	1.57
<b>7</b> 5	6/4/20	24		55		3.5		10	1.	57	1.57
76	6/5/20	24		58		3.5		10	1.	66	1.57
77	6/6/20	24		56		3.5		10	1.	60	1.57
78	6/7/20	24		55		3.5		10	1.	57	1.57
79	6/10/20	24		44		3.5		10	1.	26	1.57
80	6/11/20	24		54		3.5		10	1.	54	1.57
81	6/12/20	24		61		3.5		10	1.	74	1.57
82	6/13/20	24		49		3.5		10	1.	40	1.57
84	6/17/20	24		52		3.5		10	1.	49	1.57
85	6/18/20	24		64		3.5		10	1.	83	1.57
89	6/24/20	24		44		3.5		10	1.	26	1.57



### After Implementation

- After Implementation
  - 8 Hour Work Shift
  - Headcount = 3.5 People
  - AVG Production = 50 Doors
  - AVG UPM = 6.2 Doors
  - AVG UPMH = 1.70
- Extrapolating "After Implementation" Results to a 10 Hour Work Shift
  - 10 Hour Work Shift
  - Headcount = 3.5 People
  - AVG Production = 62 Doors
  - AVG UPH = 6.2 Doors
  - AVG UPMH = 1.77

	А	В	С	D	E	F	
1	Date 🔻	Production 🔻	People 🕶	Work Shift 🕶	UPMH 🔻	UPMH Target	
98	7/9/2024	47	3.5	8	1.68	1.57	
99	7/10/2024	50	3.5	8	1.79	1.57	
100	7/11/2024	44	3.5	8	1.57	1.57	
101	7/12/2024	57	3.5	8	2.04	1.57	
102	7/15/2024	45	3.5	8	1.61	1.57	
103	7/16/2024	48	3.5	8	1.71	1.57	
105	7/18/2024	46	3.5	8	1.64	1.57	
106	7/19/2024	49	3.5	8	1.75	1.57	
113	7/22/2024	39	3.5	8	1.39	1.57	
114	7/23/2024	56	3.5	8	2.00	1.57	
115	7/24/2024	52	3.5	8	1.86	1.57	
116	7/25/2024	54	3.5	8	1.93	1.57	
119							



### 90 Min Data Collection

- **Headcount** = 3.5 Employees.
  - 1. Jeff (Prepper)
  - 2. Tito (Builder)
  - 3. Ruben (Builder)
  - 4. Anthony (Team Lead)
- Prep Station Cycle Time = 3 Minutes
  - Prep Cycle Time 80% Efficiency = 3.6 Minutes
- Building Station Cycle Time = 6 Minutes
  - Building Station 80% Efficiency = 7.2 Minutes
- Available Time (AT) = 450 Minutes
- Production Capacity (80% Efficiency) = 63 Doors/Day
- Average Daily Demand = 52 Doors/Day
- Takt Time (AT/Demand) = 450/52 = 8.50 Minutes

### **Station Cycle Time (Minutes)**



### 90 Min Area Layout

