Flow & Batch Size

The best batch size is one piece flow, or make one and move one!

*Slide courtesy of NHMEP*
Creating Flow

• Keep the process flowing.
POUS (Point of use tool storage)

Lean Tools
5S

Deciding Locations - POUS
KANBAN
(Pull Systems Min Max and Automatic Triggers)
Getting it right the first time

BIM is a critical part
- “Measure twice cut once”
- Build it twice, construct it once
KAIZEN
Flat Organizational Culture
Getting Better at Getting Better, Part III: 

Lean Thinking
On Site and In the Office

NESEA Building Energy Boston 2017

ANDREW DEY, 
Operations Director, Unity Homes
Waste in Construction

Manufacturing
- Non-Value Added: 62%
- Support Activity: 26%
- Value Added: 12%

Construction
- Non-Value Added: 57%
- Support Activity: 10%
- Value Added: 33%

Eastman et al., BIM Handbook, John Wiley and Sons, 2009
Timeline: Lean in Construction

1988: Toyota Production System published
1992: Lean first considered applicable for construction
1995: First paper published on Scrum method
1999: Last Planner System Published
2000: First XP book published
2001: Agile Manifesto
2007: WorkFace Planning Published

copyright Ennova 2011
Lean Manufacturing vs Lean Construction

**SHARED PRINCIPLES**

- **Optimisation** of entire system through **collaboration** and systematic **learning**
- **Continual improvement** and pursuit of perfection **involving everyone**
- Focus on **delivering the value** desired by the owner/client/end-user
- **Creating flow** through eliminating obstacles to creating value and eliminating processes that create no value
- **Creating pull** production

**DIFFERENCES**

- Construction projects are generally unique (one-of-a-kind) prototypes
- Multiple contractors/suppliers act have varying contractual relationships
- Construction environments are typically outdoors and/or difficult to control
- Geographic separation of teams adds complexity to coordination and information sharing

www.ennova.com
We’re Not Alone!

Lean Construction Institute
Transforming the Built Environment

SKANSKA

LEAN CONSTRUCTION

IGLC
Most Common Causes of Construction Overruns

• Poor or incomplete design and documentation
• Client scope change during construction
• Mistakes during construction
• Delays in decision making or instructions
• Poor communication and information dissemination
• Poor planning and scheduling
• Weather
• Labor skills, availability or disputes
• Incorrect material types or quantity
Lean on Site: Tools, Process and Culture

Process

Integrated Project Delivery Strategy
(Commercial)

Lean Project Delivery Methods & Management
(Operating System)

Productivity

Transformational Change
(Organizational)

Tools

Culture
# Tools: Site Schedule

<table>
<thead>
<tr>
<th>Day of Week, Date &gt;&gt;</th>
<th>Monday, (date?)</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Truck #, Trailer Type &gt;&gt;</strong></td>
<td>Truck 1 - Step deck</td>
<td>Truck 5 - 8am</td>
<td>Truck 7</td>
<td>Truck 5 - 8am</td>
<td>Truck 7</td>
</tr>
<tr>
<td><strong>Time on Site &gt;&gt;</strong></td>
<td>8am</td>
<td>8:00am</td>
<td>8am</td>
<td>8am</td>
<td>8am</td>
</tr>
<tr>
<td><strong>Materials on Truck &gt;&gt;</strong></td>
<td>WD3, WD2, WD5, WD3, WD2, Timber brackets, truss sheathing</td>
<td>OX01, OX02, OX03, OX04, OX05, RO1, RO2, GAR Roof Apps, Timber Brackets</td>
<td>RO1, RO2, RO4, Ext timber posts, ext timber plates</td>
<td>RO1, RO2, RO4, Ext timber posts, ext timber plates</td>
<td>RO1, RO2, RO4, Ext timber posts, ext timber plates</td>
</tr>
<tr>
<td><strong>Crane Start Time &gt;&gt;</strong></td>
<td>7am</td>
<td>7am</td>
<td>7am</td>
<td>7am</td>
<td>7am</td>
</tr>
<tr>
<td><strong>1360, 050 Travel labor</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Tasks &amp; Times: 7:00</strong></td>
<td>3690, 050 - Shipping - Site truck 1</td>
<td>6118, 050 - Interior Partitions - Site</td>
<td>6132, 050 - Timber Frame - Site Labor</td>
<td>6192, 060 - RP Custom - Site</td>
<td>6192, 060 - RP Custom - Site</td>
</tr>
<tr>
<td><strong>8:00</strong></td>
<td>6129, 050 - VIP Custom - Site Labor</td>
<td>Set interior 21 than int timberframe</td>
<td>Ext posts, 106, 113, 105</td>
<td>RF C01, C02</td>
<td>RF F01, F02</td>
</tr>
<tr>
<td><strong>9:00</strong></td>
<td>Start with 701 bump (4 picks)</td>
<td>int05, 15, 19, 22, 23</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>10:00</strong></td>
<td>Then F02 (3 picks) max 301 bump/4 picks</td>
<td>int35, 36, 37, 27, 28</td>
<td>6112, 050 - Callong Joint Framing - Site</td>
<td>RF C03, C04</td>
<td>RF P03, P05</td>
</tr>
<tr>
<td><strong>11:00</strong></td>
<td>1360, 050 - Shipping - Site truck 2 unload</td>
<td>Int29, 30, 31, 32</td>
<td>Ext porch wall 02, ext CL01, ext Cl02</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>12:00</strong></td>
<td>Set posts</td>
<td>check wall 02</td>
<td></td>
<td>RF - porch 01, 02</td>
<td></td>
</tr>
<tr>
<td><strong>12:30</strong></td>
<td>Int 33, 34, 25, 26</td>
<td></td>
<td>RF C05, CHK wall01</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>13:00</strong></td>
<td>501 bump (4 picks)</td>
<td>Int 17, 18, 16</td>
<td>Ext porch wall 01</td>
<td>CRKT Pcs</td>
<td></td>
</tr>
<tr>
<td><strong>2:30</strong></td>
<td>C02, 302, B02</td>
<td>CL 07, 08, 03, 04, 05</td>
<td>Chk wall 02</td>
<td>6130, 050 - Timber Frame - Site Labor</td>
<td></td>
</tr>
<tr>
<td><strong>3:30</strong></td>
<td>P04, P05, T02, D04</td>
<td>6117, 050 - Exterior Deck Framing - S Prep for Roof</td>
<td>timber plate 117</td>
<td>Clean up for weekend</td>
<td></td>
</tr>
<tr>
<td><strong>4:30</strong></td>
<td>M02, D02, B02</td>
<td>Deck 02, 01, 04, 03</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>5:00</strong></td>
<td>22 picks</td>
<td>32 picks</td>
<td>10 picks</td>
<td>8 picks</td>
<td></td>
</tr>
</tbody>
</table>
Site Book

Sweeney-Chandler Project
Somerville, NJ
Tools: Site Signage

AIR TIGHT CONSTRUCTION

No cutting, stapling or drilling air barriers! Trades are responsible for properly air sealing any necessary penetrations. See supervisor.

No combustion heaters, air tight construction poses carbon monoxide threat.
Process: Pre-sheathing Truss Roofs
Process: Bath Pods
Process: Last Planner System

- **Master Schedule**: Set milestones and key dates
- **Phase Schedule**: Specify handoffs between trades
- **Look-Ahead Plan**: Make ready and initiate re-planning as required
- **Feedback & Learning**: Measure progress and remedy issues

**Steps**:
- **Should Do**
  - Phase Schedule
- **Can Do**
  - Look-Ahead Plan
- **Improving**
  - Feedback & Learning
- **Will Do**
  - Weekly Work Plan
- **Doing & Done**
  - Progress Tracking
Culture: Early Stakeholder Involvement
Lean in the Office: Tools, Process and Culture

- Process
- Tools
- Culture
Tools: Value Stream Mapping

If you can’t describe what you are doing as a process, Then you don’t know what you are doing.

—W. Edwards Deming
# Tools: Value Stream Mapping at Unity

## Unity Future State - Gathers From Raw - Whole House

### Engineering
- V-FAB
- Sales/Marketing
- Product Mkt
- Security Mkt

### Design
- Milestones

---

![Value Stream Mapping Diagram](image-url)
Creating Subcontracts - Standard Operating Procedure
14JUL15
Created by: Dawson Oot

Description: This SOP will cover how to create a new Subcontract within the Unity Homes guidelines.

- Before opening Sage and beginning this process, please ensure that you have the following items:
  - Scope of the work being completed by subcontractor
  - Dates of engagement
  - Vendor information
  - Cost Code(s)
  - Subcontract Amount

- Open Sage 100 Contractor application
  - A small popup window will open entitled "Company List"
  - Select Unity Building Technologies, Inc.
  - Click "Open"
  - Enter your username and password when prompted (ask your team leader if you have not been provided with this information).

- Open a new Subcontract (6-7-1)
  - Under "System Menu" on the left of screen
  - Click dropdown arrow next to "6 - Project Management"
  - Click dropdown arrow next to "7 - Subcontracts"
  - Double-click on "1 - Subcontracts"

- As with every process in Sage, all of the fields marked with an * MUST be completed in order to finalize document. Start by completing the necessary fields in the upper section.
  - Job: Input the Job # (if you know it) and press Enter. If you do not know the Job # you can click the down-arrow next to the Job field and then select the correct job from the provided list.
  - Phase: N/A
  - Vendor: Input the Vendor # (if you know it) and press Enter. If you do not know the
Process: Flash Meetings (aka “Q-DIP”)
Process: Obeya - the “Big Room” - and Visual Planning
## Improvement Task Chart

<table>
<thead>
<tr>
<th>IMPROVEMENT</th>
<th>BEST IDEA</th>
<th>STEP 1</th>
<th>STEP 2</th>
<th>STEP 3</th>
<th>STEP 4</th>
<th>STEP 5</th>
<th>DUE</th>
<th>LEADER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>

*Details on each task can be provided based on the sticky notes attached to the chart.*

![Image of a spacious workshop with workers engaging in a task]

*Unity Homes and Bensonwood logos are present.*
Progress Through Continuous Improvement
Culture: “Each of us has two jobs”
Culture: Shared Leadership

Acela Locomotive

Shinkansen “Bullet” Train
Lean Process
Inspiring and Empowering People
Raising quality
Applying kanbans, kaizens and Value Stream Mapping
to get rid of muda, mura and muri*

*uneven production) muda, waste mura, overworking muri