Lean and Takt Time Planning at Hospital Project in San Francisco

Meeli Linnik
Agenda

- Who am I?
- Lean – Tools vs. Culture
- Project Overview
- How do we implement lean?
  - Integrated Team
  - Production System Design
- Takt Time Planning
- Plus/Delta
- Questions
Who am I?
Who am I?

- 2005: TTK õpingute algus
- 2007: Celander Ehitus Objekti-insener
- 2008: Lõputõö teema valik ja kirjutamine, Rand & Tuulberg Objekti-insener
- 2009: ETET Asutamine, TKTK Baka Lõpetamine
- 2009-11: TTÜ Magistri-õpingud, UC Berkeley Visiting Scholar
- 2011: TTÜ Magistri-kraad
- 2011-2014: Timmitud Ehituse Insener – Boldt Company
Who am I?
Lean tools vs. culture
Can someone finally tell me what is Lean?
What is Lean?

- Process
- Flow
- Problem-Solving
- Case Study
- Kaizen
- Value
- Trust
- Daily-Huddle
- Collaboration
- Last-Planner-System
- Takt
- Segaduses
- Phase Schedule
- Production System
- Saigou
- 5 Why
- First-Run-Study
- Value-Stream-Mapping
- Eliminate
- Waste
- Creativity
- Lean
- Customer-Value
- Leadership
- BIM
- Just-in-Time
- Agile
What is Lean?
What is Lean?
What is Lean?
Lean is problem-solving?
What about if you do not have problems?
Tools vs. Culture

I got 99 problems but I'm gonna take a nap and ignore them all.

- Lean is 90% culture / people-based and 10% tools-based.
Industry in US
Project Overview
Projects in San Francisco

- Pacific Campus
- Van Ness & Geary Campus
- Davies Campus
- St. Luke’s Campus
Why so much Hospital Construction?

- By 2001, hospitals reported the findings of their evaluation. They showed that approximately 40 percent of California's hospital buildings are at risk of collapse in a major earthquake.

Summary

- California's seismic retrofit ordinances and compliance program is spurring construction of new hospitals. This is due to many older facilities not meeting newer building codes.

- New hospital construction will spur increased spending on hospital equipment and items. New spending on beds, radiology and imaging equipment, operating room equipment, etc.

- Organizations with heavy exposure to California hospitals will be negatively impacted by increased capex while other companies will have positive impacts due to increased sales.

On Jan. 17, 1994, millions of residents across the Los Angeles Basin were jolted awake by a 6.7 magnitude earthquake. Sirens howled, power lines arced and buildings crumbled. The Northridge quake killed 60 people, injured more than 7,000 and crippled hospitals throughout the Los Angeles area, blackening emergency rooms and shutting down ventilators and other live-saving equipment.

Meeting Deadlines

Reports showed that 80 percent of hospitals are on track to be retrofitted by 2015. According to data posted on the OSHPD site, 129 hospitals with 403 buildings will meet the state's hospital seismic requirement by January 2013. Another 55 hospitals with 153 buildings will be compliant by 2015.

The remaining 20 percent plan to complete seismic retrofitting by Jan. 1, 2020, though not every facility that's planning completion after 2015 has been verified as eligible for such an extension, said OSHPD spokesman David Byrnes.
## Project Overview

<table>
<thead>
<tr>
<th>Project</th>
<th>Approximate BGSF (excluding parking)</th>
<th>Estimate of Construction Costs</th>
<th>Estimate of Field Labor (fully burdened)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VNGC Hospital</td>
<td>740,000</td>
<td>$1,050M</td>
<td>$350M</td>
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<tr>
<td>VNGC MOB</td>
<td>250,000</td>
<td>$160M</td>
<td>$55M</td>
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<tr>
<td>St. Luke’s</td>
<td>215,000</td>
<td>$299M</td>
<td>$100M</td>
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</tbody>
</table>
Project Overview
St. Luke’s Project Overview

- 7 Stories above grade
- Approximately 234,000 square feet of acute care, clinical and building infrastructure space.
- The hospital will have a total of 120-beds
- 10 ICUs
- 22 labor/delivery and postpartum beds
- Supporting services include an imaging department with a MRI and five operating rooms
- An emergency department with 16 exam/treatment rooms
How do we implement Lean
Integrated Team

Owner (Sutter Health)

Architect (SmithGroupJJR/Boulder Associates)

General Contractor (HerreroBoldt)
Integrated Team

- Over 40 Trade Partners, Subcontractors and Consultants
- 80% of scope Risk & Reward Members
Lean Comes to Construction – Towards Root Cause

My company is moving to a “Just In Time” inventory strategy. You’ll deliver when we need it.

So... your success depends on my company doing what it promises? You have my deepest sympathy.

I feel a sharp, stabbing pain in my chest. And so it begins.
Integrated Team

- Overhead & Profit – at Risk
- Contingency (Buffer)
- Cost of Work
The **purpose** of the Production Planning and control system is to ensure **predictable** and **streamlined work flow** through a **simple** and **structured** process that brings problems to the surface to promote continuous improvement.
Production System Design

- Renovating a bathroom vs. building a hospital
Beyond Last Planner – Takt Time Planning
Why Last Planner System?

- We are on budget
- We are on time
- We are all good
- We are all like usual – last 50 years
Why Last Planner System?

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Why Last Planner System

As global demand for buildings increases — capacity to produce them decreases!

250%  world urban population = demand for buildings

200%  US non-farm industries productivity

150%  ~1.0 billion

100%  

50%  US construction industry productivity

The urban growth trajectory illustrates the growing gap between the increasing global demand for buildings & the decline in the construction industry’s productivity:

The construction industry v. US non-farm industries — productivity index
So, what?

Average - 54 %
### STL - Beyond Last Planner System

#### Master Schedule

| Entire Project |

#### Phase Schedule

| 1 mn | 2 mn | 3 mn | 4 mn | 5 mn |

#### Production Optimization

| 1 wk | 1 wk | 1 wk | 1 wk | 1 wk |

#### Weekly Lookahead Planning and Commitments

#### Daily Plan Execution at Crew Level
Master Schedule

- The first level of planning
- Hard milestones derived from Owner or Contract documents
Phase Schedule

- A pull planning phase that identifies the larger durations or blocks of work in 1-4 month increments
- Outlines the overall expectations
- Usually from early planning by GC and some key trades
Production Strategy (Takt Planning)

Monthly planning cycles with Superintendents & Production Team
• The floor plan is divided in areas with similar scope of work
• All durations set to a consistent cycle (Week, 4 days, 3 days, 1 day, 1 h)
• Balancing of workflow
Lookahead Planning and Constraints

Weekly Planning Cycle with Foremen and Superintendents

- Identify constraints and gain commitments for removal
- Break down weekly handoffs into daily tasks (usually for a 2-4 week window)
- Plan for needed labor and equipment; deliveries
- Make weekly commitments
Why Takt Planning?
Takt Time in Construction

- Straight forward in manufacturing
- In construction, traditionally various installation speeds create complexity
- Any capacity in the system that exceeds the capacity of the slowest trade is **WASTE** *(currently minimized by complex scheduling between multiple work areas to maintain flow)*
A Parade of Trades

The construction worker Richmond Shreve of the Empire State Building project providing an answer to what a balanced LEAN job can look like:

“We always though of it as a parade in which each marcher kept pace and the parade marched out of the top of the building, still in perfect step”.

“Sometimes we thought of it as a great assembly line, only the assembly line did the moving, the finished product stayed in place”
To illustrate the production strategy in a Takt system, one can think of the following five principles:

1. Each floor is broken up into areas with similar amount of scope
2. Each discipline has set uniform duration to complete each area
3. Only one trade is occupying each area at the same time
4. All disciplines’ material is delivered to ‘their’ work area only
5. All disciplines complete and move to the next area every Friday
The Takt System
Align All Resources

Pull

To support the steady flow of production it is essential that each car, or discipline, pulls in the needed resources to stay on track:

- Information
- Material
- Manpower
To produce defect-free work each discipline needs to package all production and installation information to align with the areas of each disciplines' weekly handoff. The process will include BIM, drawings, specifications, production plans, and Built-in Quality (BIQ) manuals that support building each area right the first time, on time.
Material and Equipment

- Material will be procured, fabricated, packaged and delivered in the order of installation and to support each discipline’s weekly handoff, on a ‘just in takt’ basis.
Crew Planning

- Each trade must allocate crews to each area in order to meet desired output. (80% rule)
- Each trade also must report budgeted vs. actual labor hours per area to assure timely and accurate feedback for each crew’s performance to plan (PDCA)
What does a takt time plan look like?
What does a takt time plan look like?
Myths

• Takt can be implemented only for very repetitive projects – like apartment buildings
• This is an illusion and it will never work like that
• Takt and cycle time concepts belong to manufacturing
• It needs a big team to do that and plan it out like that - it is not cost effective
• Can’t be done on small projects

• Busting these myths. Are you saying Last Planner System with takt is easy to implement?
Key Points and Questions?