Lean Construction Practices

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The New Horizons Foundation study, “Comparison of Operation Cost Factors: Union Versus Nonunion HVAC and Sheet Metal Contractors,...

Union contractors do have a higher cost structure, however that is offset in part because of our productivity.

...it is incumbent upon us—union HVAC and sheet metal contractors—to become “best in class” in both field and management productivity.

We need to be on the forefront with lean manufacturing, Building Information Management Systems and other practices that can give us a competitive advantage.

Sincerely,
Richard J. Cramer Sr.
SMACNA President
SMACNEWS June 6, 2007
Workshop Objectives

At the end of this session you will be able to explain:

- 4 Reasons for doing Lean
- 7 Wastes to Attack
- 5 Basic Lean Tools - You can use
- One choice - to Think Lean or Not!
Reason #1
Lean Works in Other Industries
Lean works in Manufacturing

- Manufacturing Lead Time - less than 1 day
- Delivered Quality – 3 PPM
- Delivery Performance – 99+% 
- Inventory Turns – Greater than 50 turns per year
- Manufacturing space - reduced 35 to 50%

Source: Lean Transformation by Bruce A. Henderson and Jeorge L Larco, 1999.
Lean Works in Government

US Army:
Red River Repair Facility in Texarkana, AR - They repair Humvees
- 2004 - Averaged 3 vehicles per week
- 2006 (Applying Lean) - 32 vehicles per day!

South Korea - a maintenance unit using Lean quick changeover techniques reduced the time to overhaul an M-1 tank from 195 to 30 days.
Lean Works in Hospitals

- Hospital acquired infections down from 10 per 1,000 days patients are on ventilators to 2 per 1,000. (Robert Wood Johnson University Hospital Hamilton)

- 5S event in hospital medical supplies - made supplies more available with 17% reduction is storage space.

Source: “Change Healthcare Organizations From Good to Great,” Quality Progress, Nov. 2005
Reason # 2: Lean works in Construction!
Lean works in Construction

**Boldt LPS Success**

- **Industrial**
  - 5 mo - $15M
  - 6 mo - $15M

- **Correctional**
  - 12 mo - $4.6M
  - 14 mo - $17M
  - 18 mo - $18M

- **Institutional**
  - 12 mo - $4.6M
  - 15 mo - $12.6M
  - 18 mo - $13M

- **Health Care**
  - 12 mo - $4.6M
  - 18 mo - $5M
Lean works in Construction

It Works at TDIndustries
Studied 50 jobs all over $300,000 in labor

average
productivity ratio

Jobs not using Lean Tool 0.97
Jobs using the new approach 0.88

Lean construction techniques saved 17% of their Projects' labor budget - a savings of $1,511,544!

Reason #3: Customers are beginning to want Lean Construction!
Customer Expectations

General Motors is challenging the industry to develop, **embrace and implement Lean Principles**:

- Expect construction firms to be proactive in applying **Lean Concepts**
- Expect near-term results from bid through implementation at the site

SMWIA/ SMACNA - 2006 Partners in Progress Conference
Sutter Health Capital Program

The Executive Challenge

- Successfully execute the design and construction of resultant $5.5B program using Lean Project Delivery Methods
Construction Users Roundtable (CURT) says:

Education is key;

There needs to be a shift in everyone’s way of thinking;

Owner’s must be the agents of change and must demand change; and

**LEAN** must become the new culture of the industry.

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Reason 4:
There is so much waste in our Industry that there is a great profit opportunity to those who go Lean!
Waste Opportunities

Research findings from the Construction Industry Institute (CII):

**Current Manufacturing**
- Waste: 26%
- Support Activity: 12%
- Value Added: 62%

**Current Construction**
- Waste: 57%
- Support Activity: 33%
- Value Added: 10%
What is Lean?

**Lean Thinking** is a shift in management's focus to differentiate between **Value** and **Waste**
AKA: JIT & Toyota Production System (TPS)

**Lean Construction** applies the principles and techniques of Lean Thinking to develop a better way to deliver the job.
AKA: Lean Project Delivery System
Value

What the customer is actually willing to PAY for (USEFULNESS/COST)

Includes Functions, Features, Time & Price

Relates to the whole product or service received

Is the opposite of WASTE.

What would be Value-Added to your customer?
7 Types of Waste (Muda) to Attack

- **Defects in products:** Rework, Field orders & Punch Lists
- **Overproduction:** Fabricating material or ordering it too soon, JIC thinking
- **Inventory:** Material stored at site or yard, work in process, unused tools & parts, forms and stashes
- **Unnecessary processing:** Double & triple estimates from suppliers, redundant or unnecessary reporting, multi signatures on forms, material requisitions or time sheets, any non-value added steps
- **Unnecessary movement of people:** Treasure hunts, looking for files, poor layout of work area (ergonomics)
- **Transport of goods:** moving material, tools or parts, handing off work between crews
- **Waiting:** Crews waiting for equipment, plans, RFI’s, field orders, or material, payroll waiting for time sheets, equipment waiting to fabricate material

What wastes have you seen this week?
Waste
Waste!

Sheet Metal waiting to be processed
Finished Duct waiting for the next process
Pathway to Lean

Value vs. Waste

The Value Stream

Flow

Pull

Pursue Perfection
Typically Value added time is about 3% of the Total Time! (Yet we tend to focus our improvement efforts on the value added steps.)
What is Lean?

Flow

Want to make **Value Flow**

Batch and Queuing VS Flow

Flow is Counterintuitive
Flow Exercise

Sign & date cards
What is Lean?

**PULL**

Means no one upstream should produce a good or service until the customer downstream asks for it. Products and services are created only on demand.
Pursue Perfection

Continuous Improvement

What if there were no WASTE at all?

The paradox is that perfection can never be achieved, but must be pursued.
Lean Principles

Operations vs. Processes

Lean focuses on the space between the steps
Lean Thinking

PDCA & Experimentation

Plan    Do
Act     Check

Plan    Do
Act     Check

Plan    Do
Act     Check

Plan    Do
Act     Check
Basic Lean Tools & Techniques

- Five S’s
- Muda Walk - “Chalk Watch”
- Process Mapping/Value Analysis
- Spaghetti Chart
- Visual Controls
The 5 S's

- Sorting
- Simplifying
- Sweeping
- Standardizing
- Self-discipline
The 5 S's

**SORTING**

Sort out the necessary from the unnecessary, discard the unnecessary.

If you don't use it - get it it out of the way!
How to Sort?

- **RED TAG**
  - USE AUCTION
    - NECESSARY ITEMS USED OR LIKELY TO BE USED
      - RARELY USED (1 - 2 times per year)
      - OCCASIONALLY USED (1 - 2 per month)
      - FREQUENTLY USED (daily or weekly use)
    - SOME VALUE
      - Look for best user to give or sell
    - NO VALUE BUT COSTLY TO DISPOSE
      - Find least costly way to dispose
    - NO VALUE & EASY TO DISPOSE OF
      - Dispose of immediately

- **NO VALUE & EASY TO DISPOSE OF**

- **UNNECESSARY ITEMS (NOT USED OR NOT LIKELY TO BE USED)**
Opportunity to Sort
Opportunities to Sort
Opportunities to Sort
The 5 S's

SIMPLIFYING

Create and identify a place for everything based on how often we use it
Simplifying Steps:

1. Put tools & material used most often closest to the work area, those used less often, further away.

2. Develop a way to label or show where everything goes. Consider:
   - Shadow board
   - Marking the item and the location
   - Color-coding
   - Labels on drawers with list of contents inside
Simplifying Steps:

3. Develop ways to daily replace usable items
   · Establish lead times for replacement of daily usage supplies
   · Determine minimum and maximum supply levels and mark them. Two Bin system
Examples of Simplifying
Simplifying
Inside a Service truck
The 5 S's

SWEEPING

Physical and Visual Control of the work area
The 5 S's

STANDARDIZING

is creating standard ways to keep the work areas organized, clean and orderly and documenting agreements made during the 5S’s.
How to Standardize?

Standardize:
- Gang Boxes
- Tools & equipment
- Shadow boards & color codes
- Yard lay-down areas
- Have clear instructions for people who deliver goods or materials to the site.
The 5 S's

SELF-DISCIPLINE
Follow through with the 5Ss agreements

Do 30 Second Test
Contractors doing 5S’s report:

- Freed up a space on both sides of the shop
- Returned $5,000 in materials
- Saved 90 field man-hours on one job by reducing crew time getting ready for job
- An accounting department got rid of 18,000 duplicate copies of shop invoices
Supply Shop After 5 S’s
Garage 5 Years ago
UMEC Tool Crib Before 5S’s

03/10/2005
Laydown Yards
Basic Lean Tools & Techniques

- Five S’s
- **Muda Walk - “Chalk Watch”**
- Process Mapping/Value Analysis
- Spaghetti Chart
- Visual Controls
Do a Muda (Waste) Walk

Go to Gemba & do “Chalk Watch”

- Flow
- Treasure Hunts
- Waste
- Standards/systems/methods
  (can’t improve if no standard way exists)
- Equipment maintenance & utilization
- Ask Why? (5 times)

Assume -the best way we do it today is the worst way tomorrow!
Find a better way to do it.
- CEO of Toyota
Sample Idea from a Muda Walk

Our shop manager and PM's had to walk - app. 90 steps every time they wanted to retrieve a fax, or info from their "in basket"

>>Bought a new machine that will fax, scan, and copy and put it back in their department just a few steps from their desks.
Sample Idea from a Muda Walk

We were scanning to many large fittings at one time on the water jet & to many uncompleted fitting’s waiting to be insulated. >>Send large fittings to finish cutting liner for 1 fitting at a time. This will eliminate a 2nd sorting of pieces and steps.
Take the Muda Walk Challenge

- Go to Gemba
- Look for waste
- 2 Improvement Ideas a month
Basic Lean Tools & Techniques

- Five S’s
- Muda Walk - “Chalk Watch”
- Process Mapping/Value Analysis
- Spaghetti Chart
- Visual Controls
Process Mapping/Value Analysis

What you think your process looks like:

What your Customer is willing to pay for (Value added)

What the real process looks like:
Process Mapping/Value Analysis

Map the steps from install duct back to sheet metal (coil) delivered to shop. Include all steps & ‘wait’ times

Do one product line at a time - rectangular straight/fittings

Measure distance traveled & cycle time

Categorize all steps into:

1) Value added
2) Non Value Added But Necessary
3) Non Value added & Not Necessary

Eliminate all #3’s and look for ways to improve #2’s by making the product flow; reduce set-up time & do 5S’s
Basic Lean Tools & Techniques

- Five S’s
- Muda Walk - “Chalk Watch”
- Process Mapping/Value Analysis
- Spaghetti Chart
- Visual Controls
Observations – look for waste
Use a spaghetti chart

- Get room order
- Get butter & Cream Cheese
- Check order
- Get juice cup
- Get bagel
- Get knife & napkins
- Deliver to room
- Get butter & Cream Cheese
- Cut bagel
- Toast bagel
- Pour juice
Basic Lean Tools & Techniques

- Five S’s
- Muda Walk - “Chalk Watch”
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- Visual Controls
Visual Controls

Purpose: To put in plain view all tools, parts, plans, schedules and performance indicators so everyone can see at a glance what is happening.

- Colored hard hats
- Posted daily/weekly schedules & progress
  
  (Board Meeting)

- Flow chart for how to run payroll
- Mark pipe/duct - one straight line
Basic Lean Tools & Techniques

- Five S’s
- Muda Walk - “Chalk Watch”
- Process Mapping/Value Analysis
- Spaghetti Chart
- Visual Controls

Which tools might work for your company?
Where to start?

Basic Rules to improve Construction

Focus - 1. Keep the Crew Installing
2. Reduce Inventory
3. Reduce Costs

Define a Key Process - Value Stream

- Steps - value added/non value added
  - Who Touches
  - Requirements
  - Process Owner

- Define/verify VALUE as seen by the customer
  > Improve Quality - Eliminate Defects
  - DON'T GET IT > DON'T MAKE IT > DON'T SEND IT

> Do Root Cause Analysis
Where to start?

- Does Value Flow - so one step leads immediately to the next with no batches?
  > Look at handoffs

- Eliminate Treasure Hunts - Organize the Workplace
  > Use 5S’s, Spaghetti Chart

Try something
Where to start?

- No Muda - 2 implemented ideas per month!
  > Use the ‘chalk watch’
- Standardize gang boxes, tools & equipment
Change Management Challenge

20 - 60 - 20 Rule

Are you in the boat?
Where to get help?

- Not many “Lean” consultants in the industry
- Some Suppliers & Customers can help
- *SMACNA - Sheet Metal Made Lean and Clean (5S’s)* By David Skinner
- Lean Construction Institute
- Some Industry Magazines
- *Lean Thinking: Tools for decreasing Cost and increasing Profit* - New Horizons Foundation
- Free monthly e-newsletter on Lean & 5S’s in Construction
Final Thought:
Profit = Elimination of *Waste* + *Loyal Customers*

To do Lean is not the question but the Answer!

> It Increases Value to the customer
and
> Drives out Waste
What's your choice?

>> Think Lean!