

Lean Construction Practices



Presented by:
Dennis Sowards,
Quality Support Services, Inc.

Research funded by the New
Horizons Foundation

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

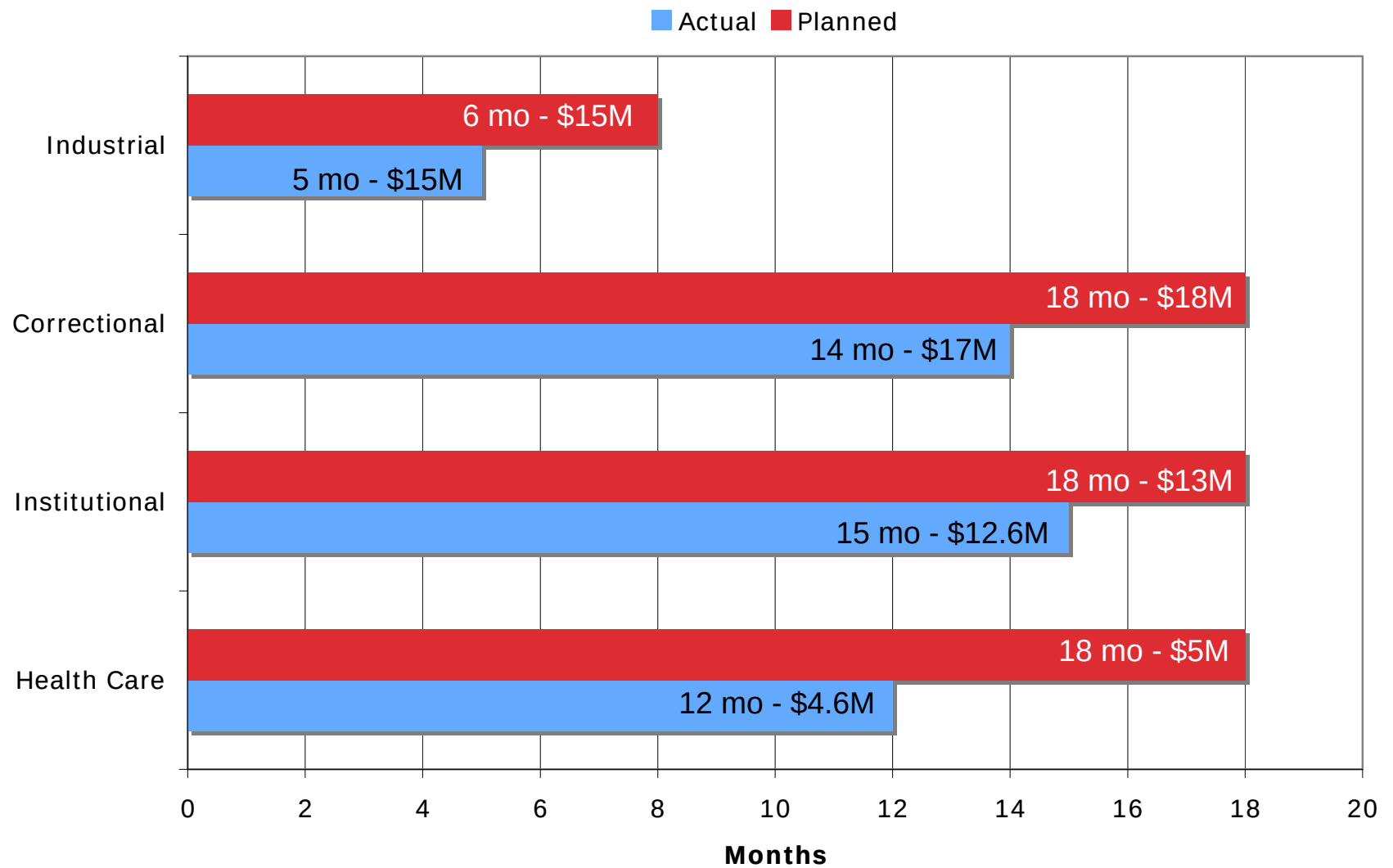
- ❑ Hospital acquired infections down from 10 per 1,000 days patients are on ventilators to 2 per 1,000. (Robert Wood Johnson University Hospital Hamilton)
- ❑ 5S event in hospital medical supplies - made supplies more available with 17% reduction in storage space.

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



Lean works in Construction

It Works at **TD Industries**

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!

Source: Jim Teston's master thesis at Clemson University: *Evaluating the Benefits of Lean Construction on Productivity* August 1998.

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.

Issued June 2007

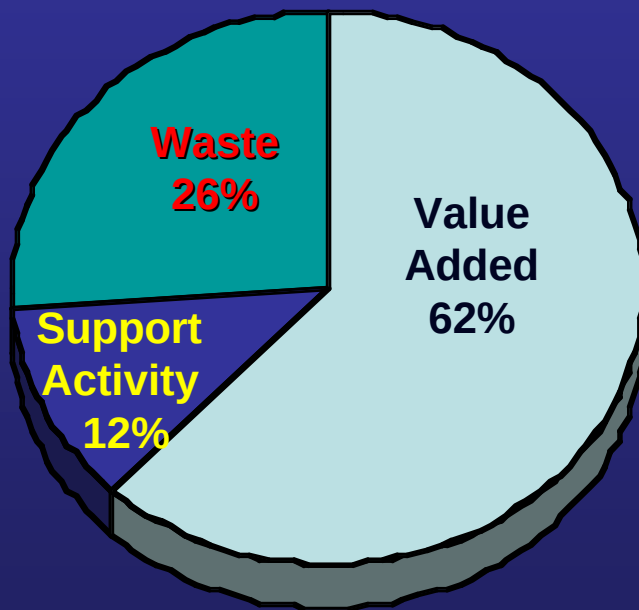
Reason 4:

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

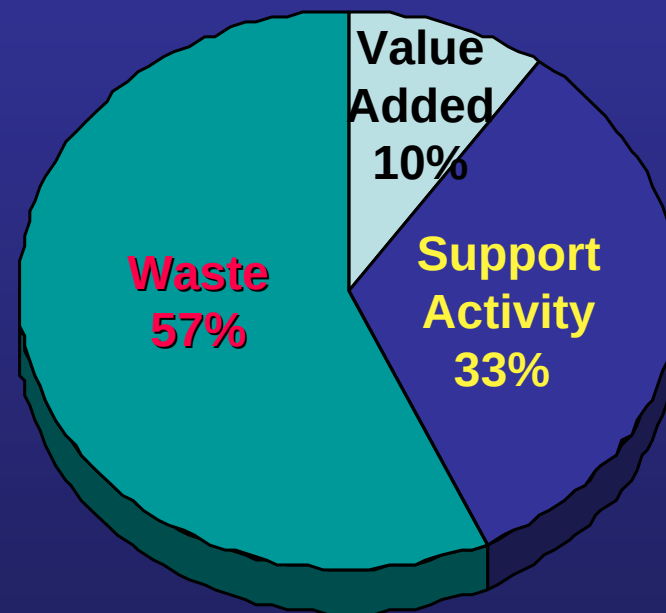
Waste Opportunities

Research findings from the Construction Industry Institute (CII):

**Current
Manufacturing**



**Current
Construction**



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!



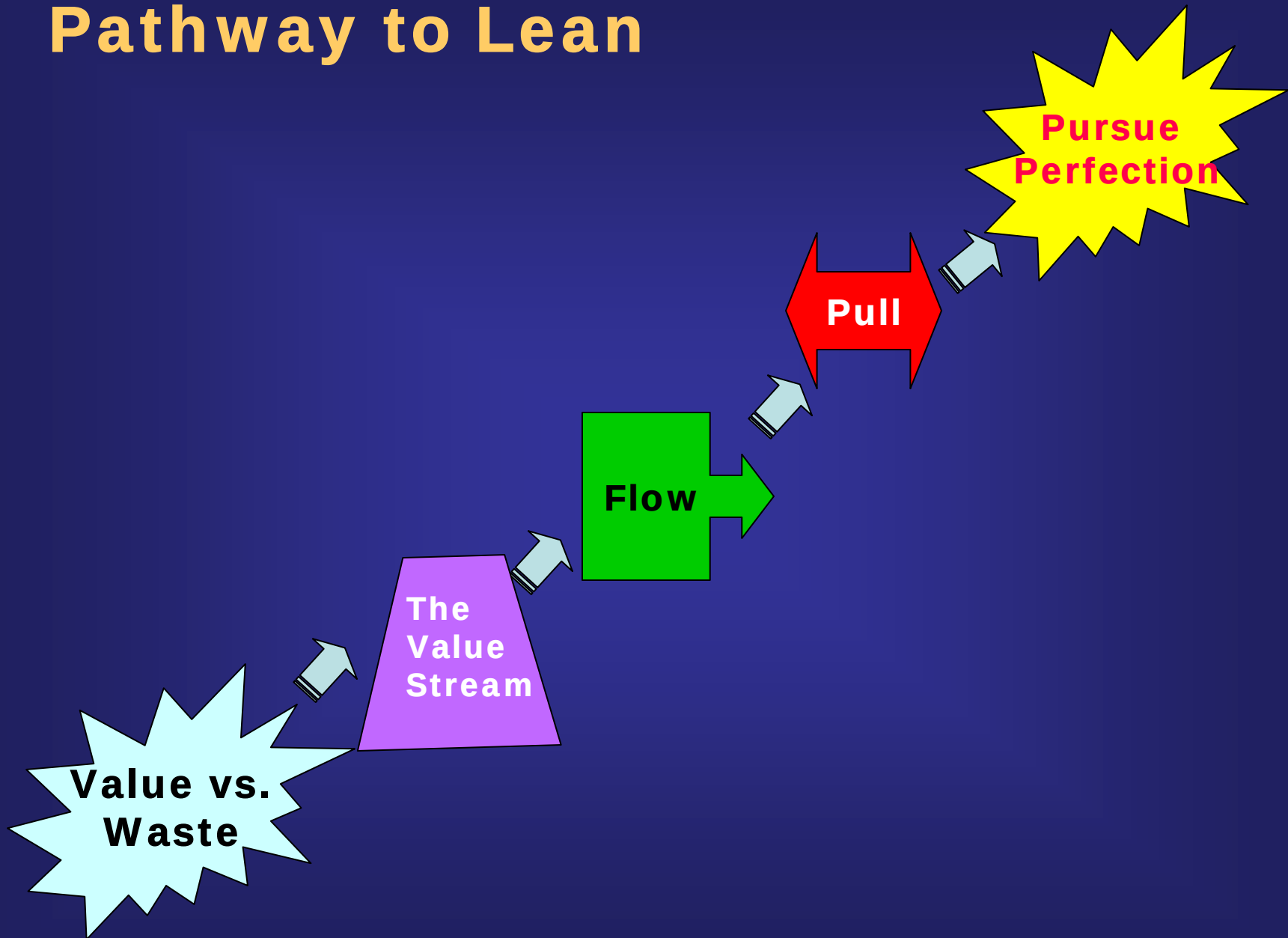
Sheet Metal waiting to be processed

Waste!



Finished Duct waiting for the next process

Pathway to Lean



Value Stream Analysis

Look at Value Added & Non-Value Added Time



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?



Want to make Value Flow

Batch and Queuing VS Flow

Flow is Counterintuitive

Flow Exercise

Sign & date cards



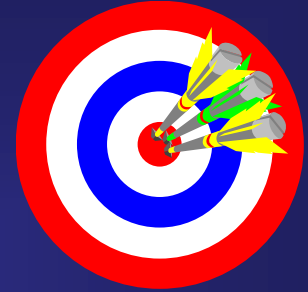
What is Lean?

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

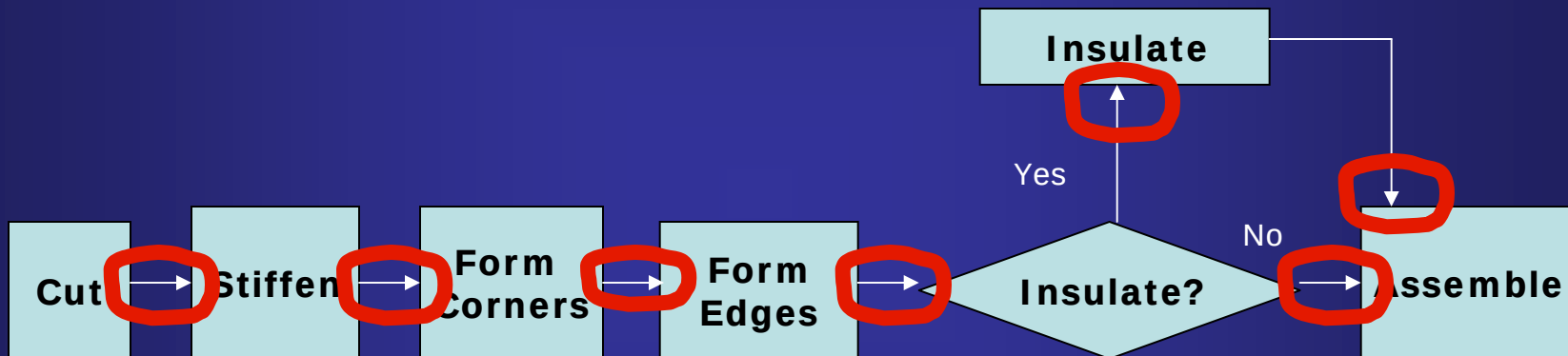


What if there were no
WASTE at all?

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

Lean Principles

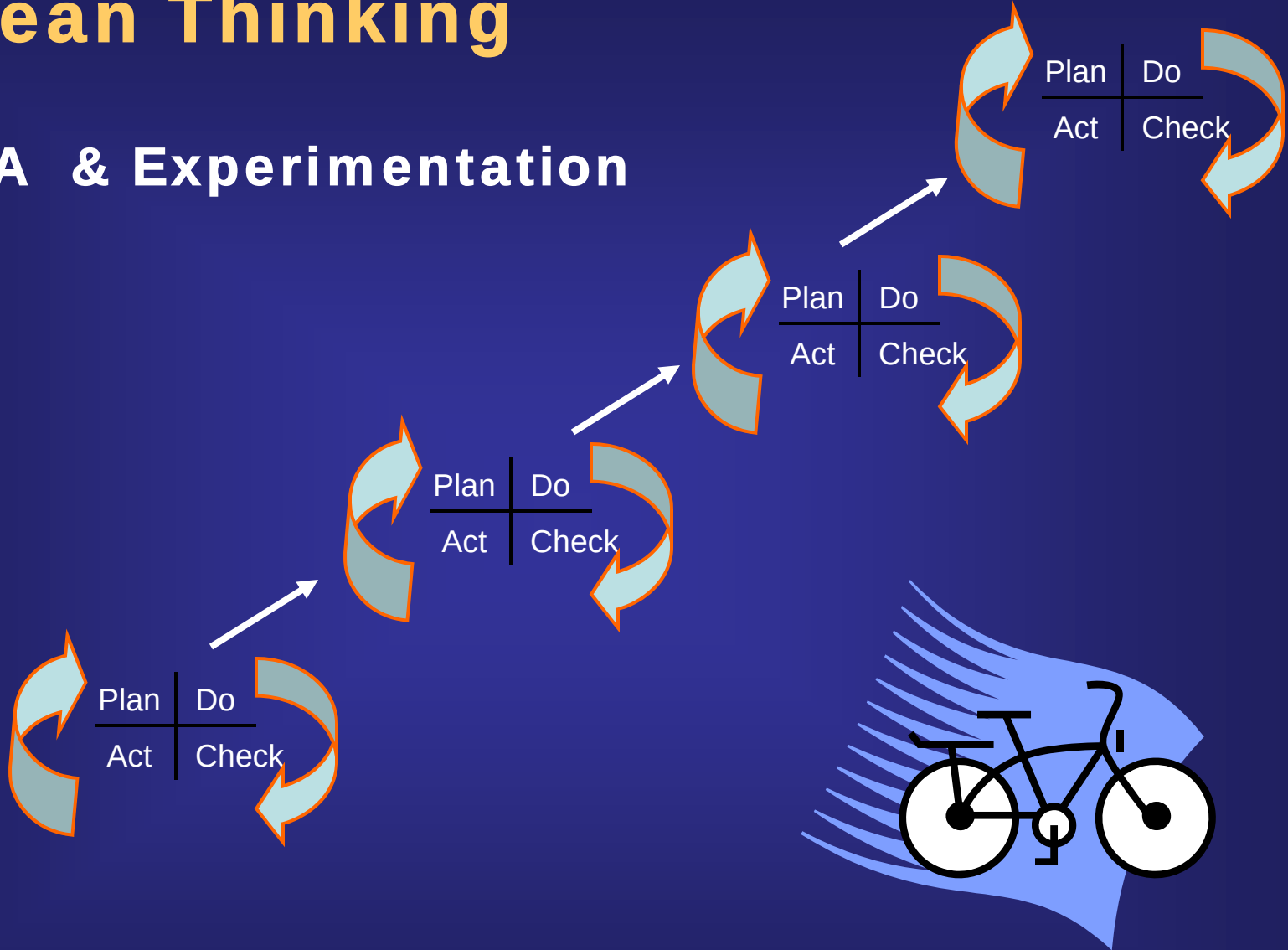
Operations vs. Processes



Lean focuses on the space between the steps

Lean Thinking

PDCA & Experimentation



Basic Lean Tools & Techniques

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

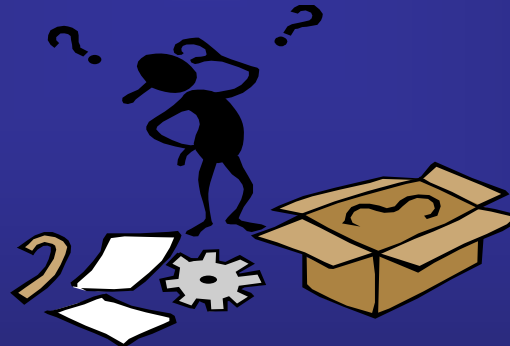
The 5 S's

- ❑ **S**orting
- ❑ **S**implifying
- ❑ **S**weeping
- ❑ **S**tandardizing
- ❑ **S**elf-discipline

The 5 S's

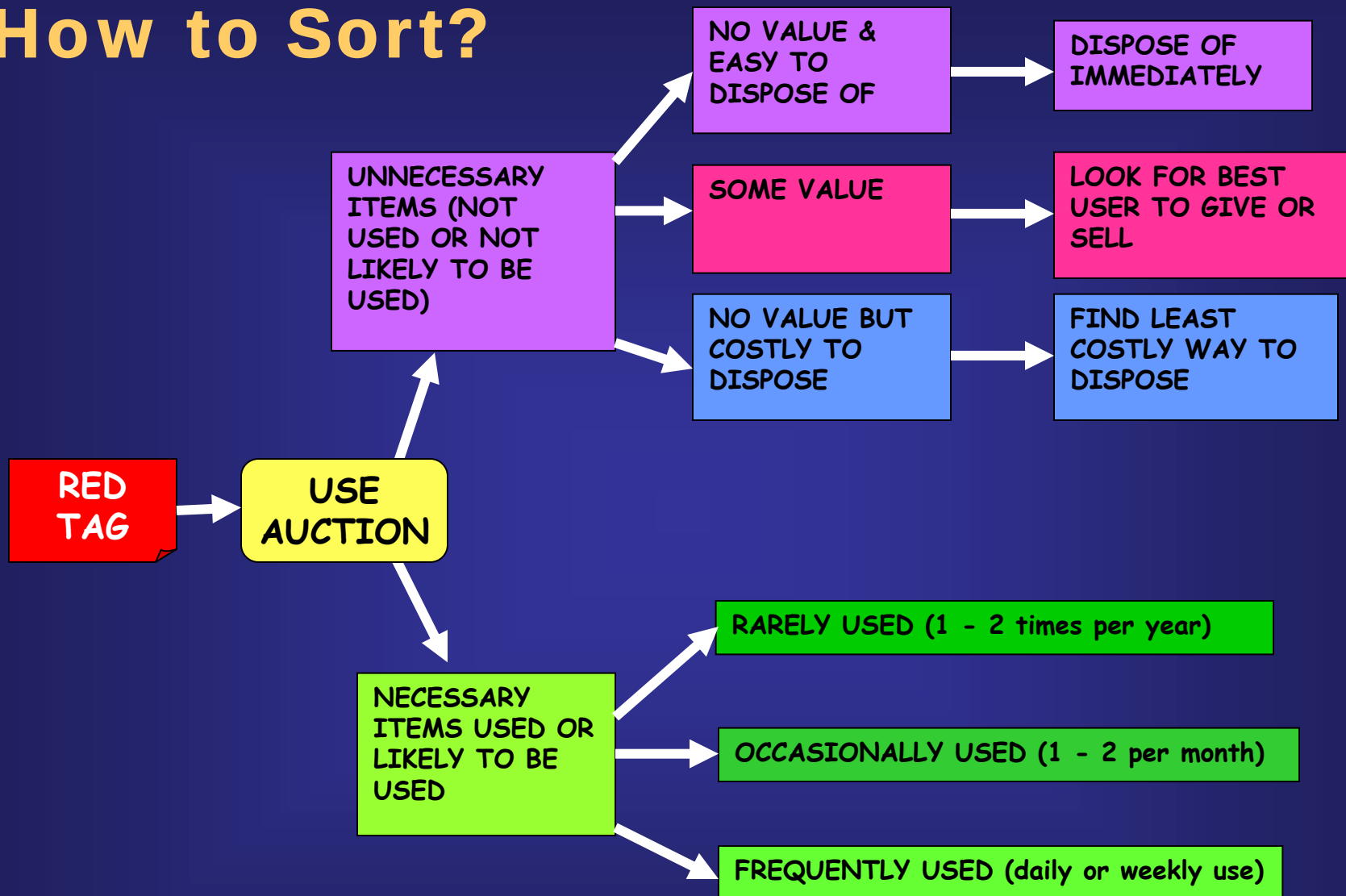
SORTING

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



If you don't use it - get it out of the way!

How to Sort?



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



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 Room - Before



Supply Shop After 5 S's





Garage 5 Years ago



**Garage 6 months
after starting 5S's**



Garage Now

UMEC Tool Crib Before 5S's



UMEC Tool Crib After 5S's



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

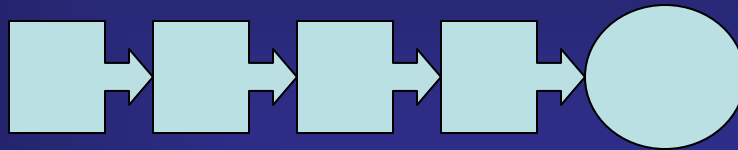
- Go to Gemba
- Look for waste
- 2 Improvement Ideas a month

Basic Lean Tools & Techniques

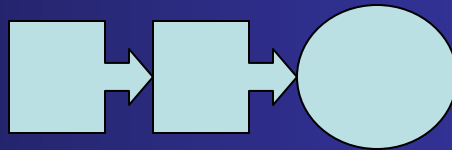
- ❑ Five S's
- ❑ Muda Walk - "Chalk Watch"
- ❑ **Process Mapping / Value Analysis**
- ❑ Spaghetti Chart
- ❑ Visual Controls

Process Mapping / Value Analysis

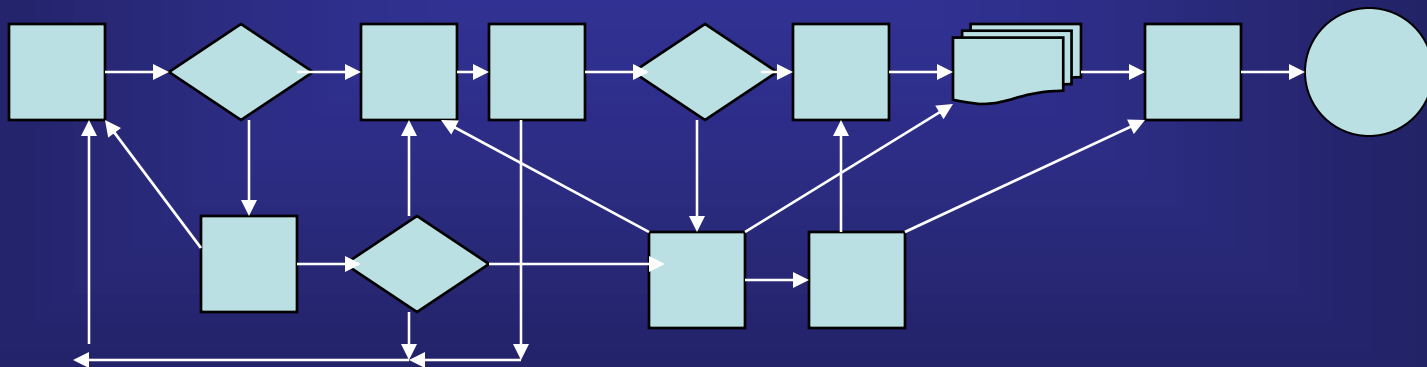
What you think your process looks like:



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

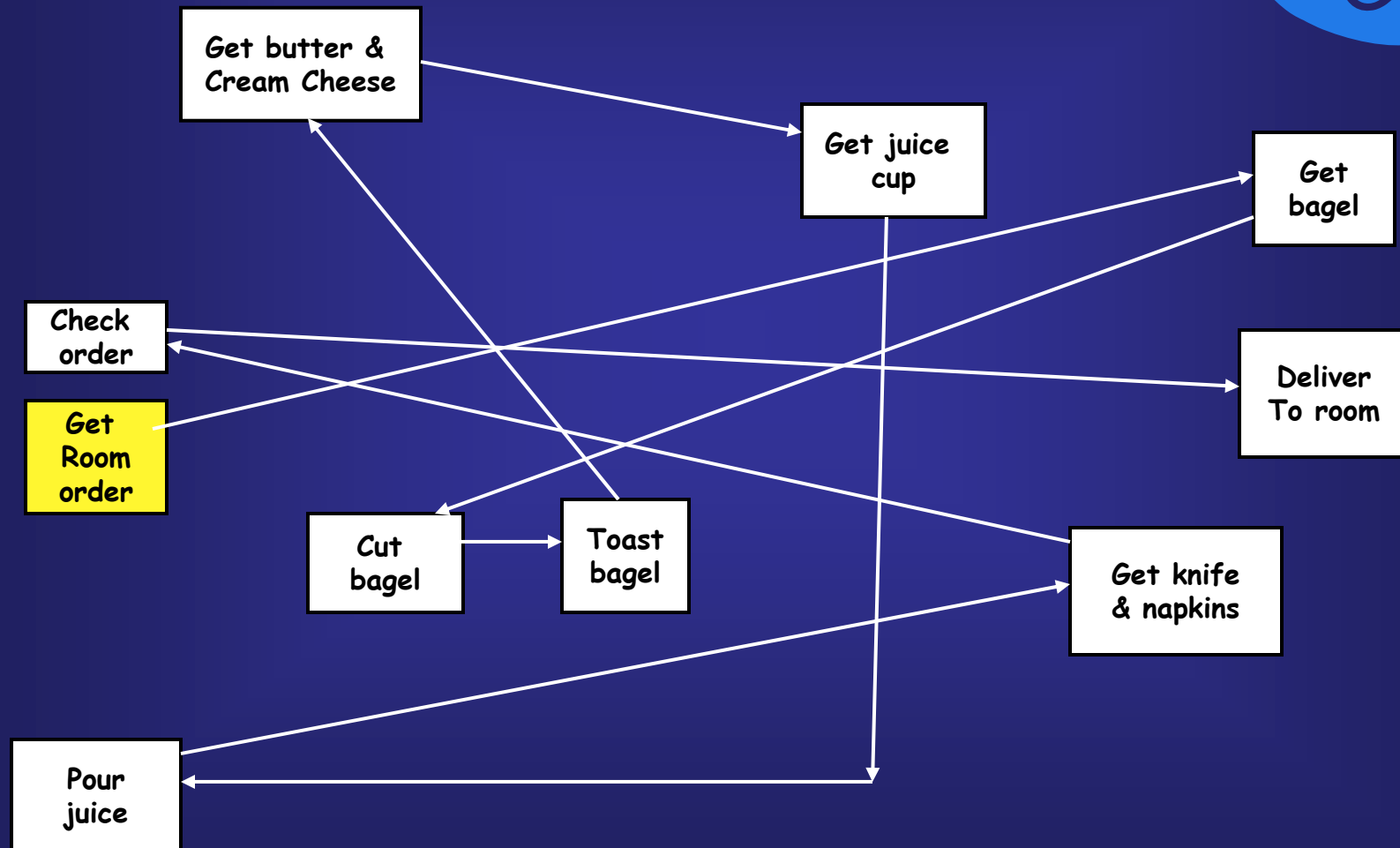
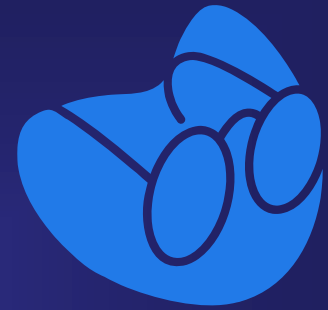
Eliminate all #3's and look for ways to improve #2's by making the product flow; reduce set-up time & do 5S's

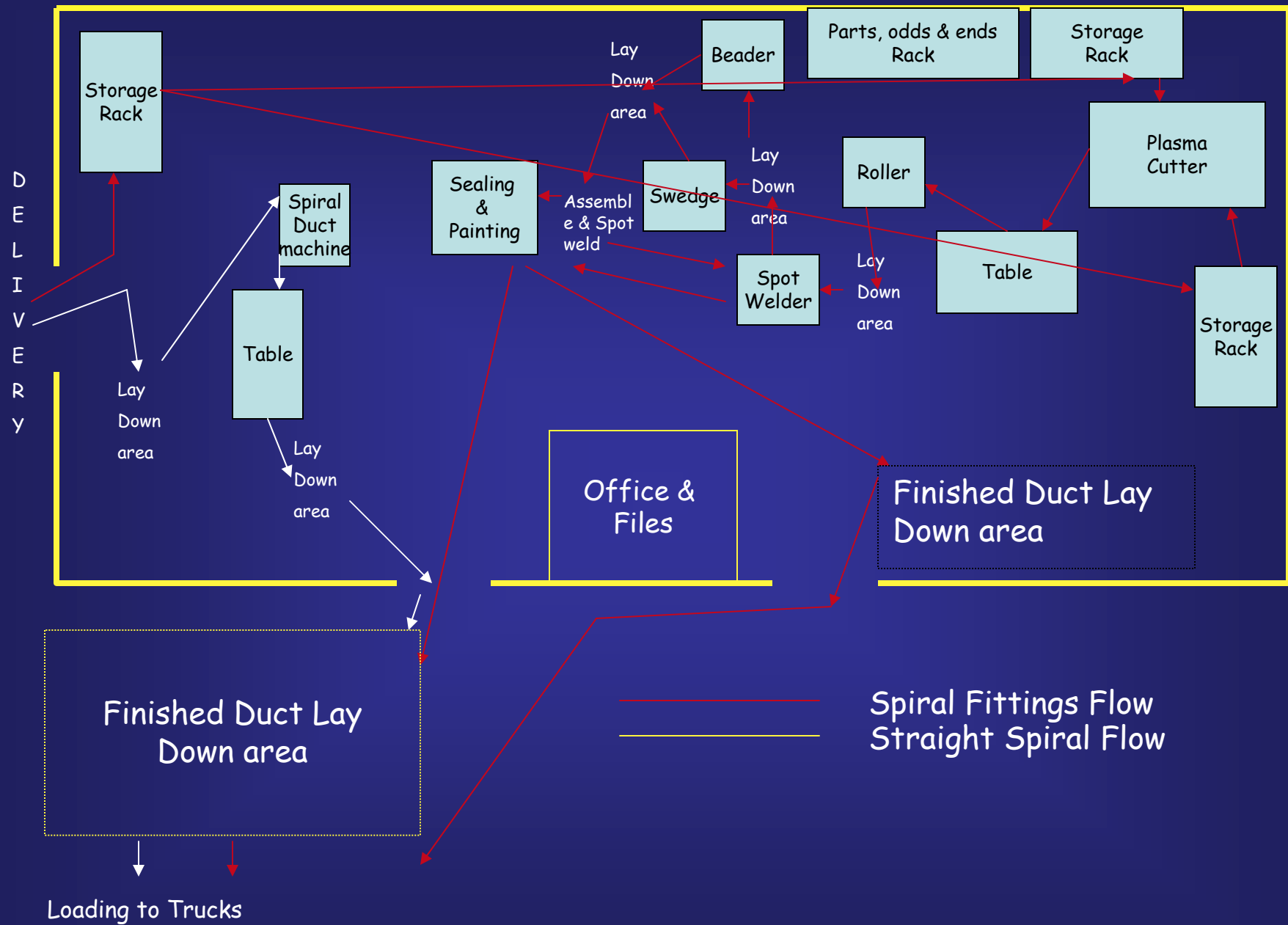
Basic Lean Tools & Techniques

- ❑ Five S's
- ❑ Muda Walk - "Chalk Watch"
- ❑ Process Mapping / Value Analysis
- ❑ Spaghetti Chart
- ❑ Visual Controls

Observations – look for waste

Use a spaghetti chart





Basic Lean Tools & Techniques

- ❑ Five S's
- ❑ Muda Walk - "Chalk Watch"
- ❑ Process Mapping / Value Analysis
- ❑ Spaghetti Chart
- ❑ 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

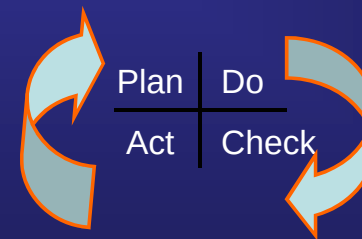
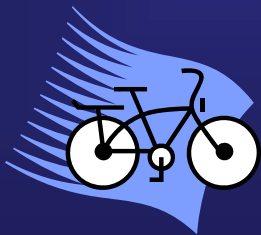
Define a Key Process - Value Stream

- 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



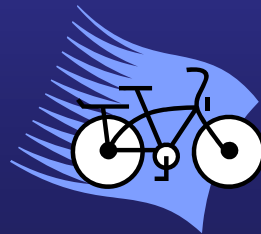
Where to start?



- ❑ No Muda - 2 implemented ideas per month!

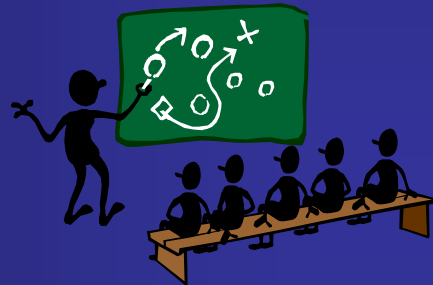
 - > Use the 'chalk watch'

- ❑ 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!