

Lean Construction & The Last Planner System™

Amanda Warren - Partner



**CONSTRUCTING
EXCELLENCE**
IN NEW ZEALAND

Agenda

- ▶ Warm up – Silent Square Game
- ▶ Quick Case Studies
- ▶ Introduction to Lean Construction
 - ▶ Afternoon Tea
- ▶ The Last Planner System – Overview
- ▶ The Airplane Game
- ▶ Plus Delta
 - ▶ Close



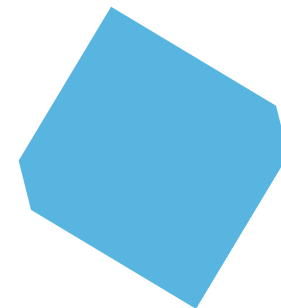
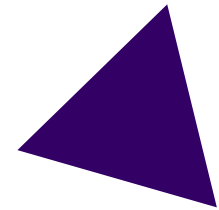
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Silent Square Game

Warmup

Silent Square Game

- ▶ Groups of five PLUS OBSERVER(S)
- ▶ Make your perfect square
- ▶ You May give pieces away
- ▶ You may accept pieces from others **PASSIVELY!**
- ▶ No talking!
- ▶ No non-verbal communication
- ▶ Definitely **NO PINCHING!**



Introductions



► Let's share....

A day when everything went right – things just flowed!

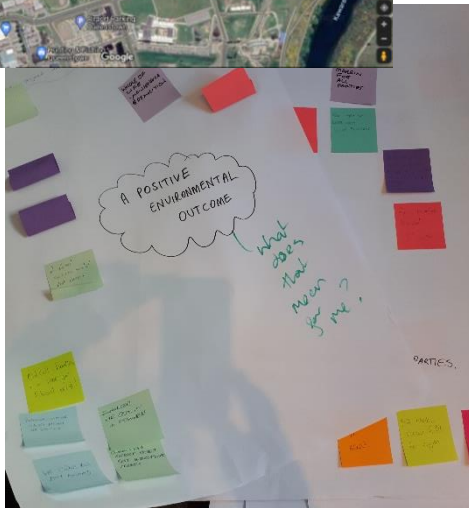


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Quick Case Studies

Presentation

Eastern Access Road – Hawthorne Drive



City Rail Link



Britomart
Station



Aotea Station



Karangahape
Station



Mt Eden
Station

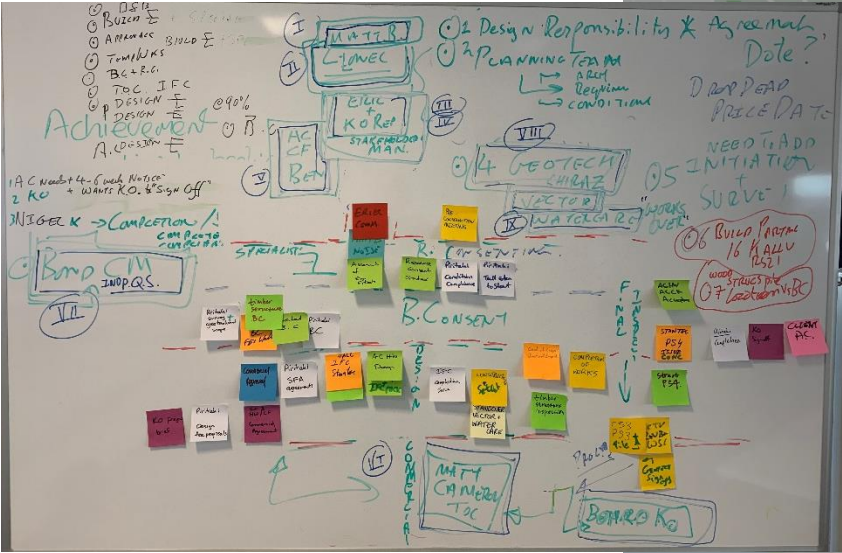
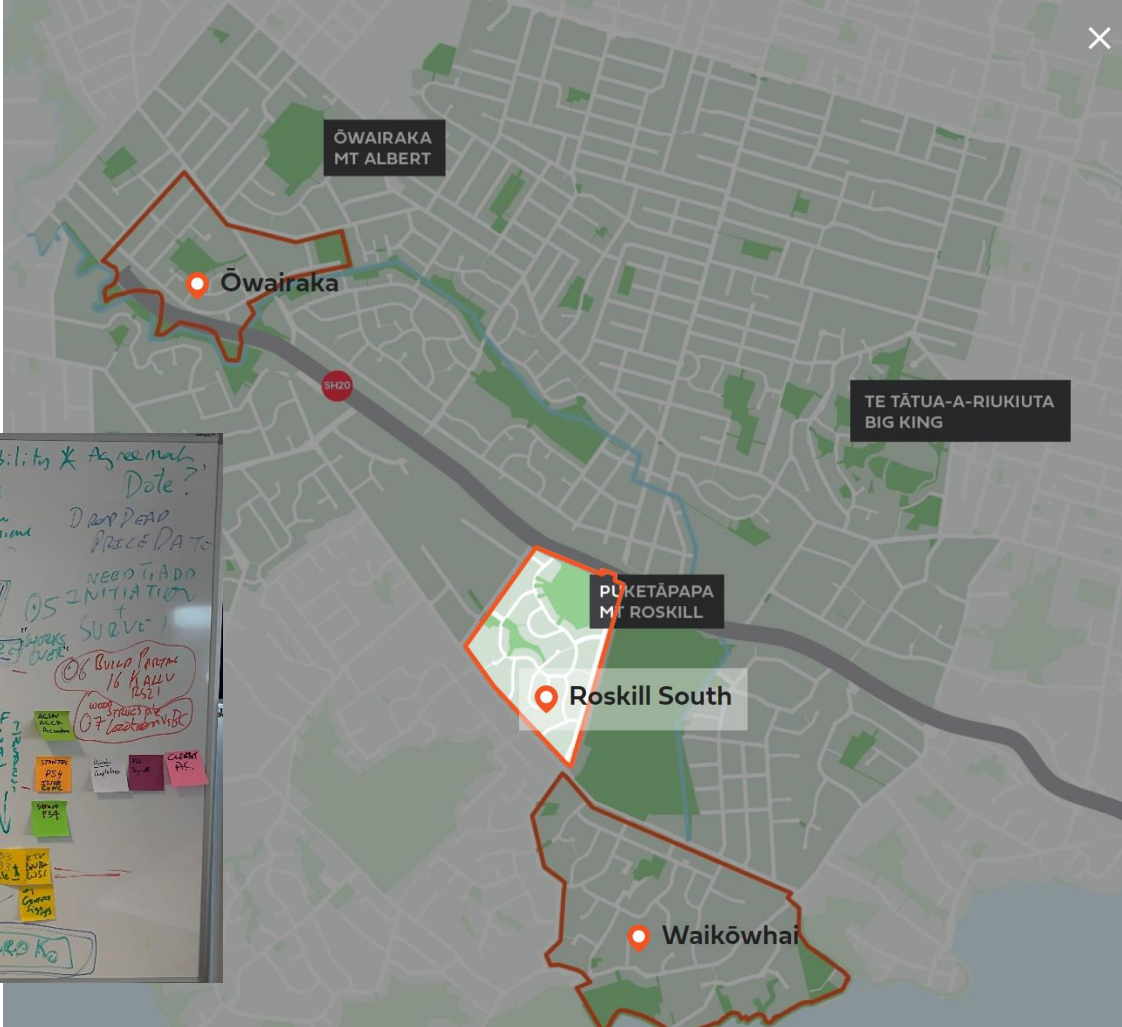
Ryman Healthcare

- ▶ 40% less labour
- ▶ Handing over units 1 month early



Piritahi – Freeland Reserve & Oranga

- ▶ TOC 20D
Bringing
Design to
Construction



Piritahi - Oranga

► TOC 27



The Oranga Development will see 1,000 new terraced and apartment homes delivered to the Oranga community over the next 8 years. These new homes will be a mix of state, market and more affordable homes that are warmer, drier and healthier to live in.

Waterview 'Blue Cards'

Capture

- ▶ 'Wastes'
- ▶ Improvements



LEAN CONSTRUCTION EFFICIENCY CARD

IMPROVEMENT IDEA

NAME & COMPANY: Tim B DATE & TIME: 2/9/13

WHAT CAN WE DO BETTER?
 more stiffeners in column cages may provide more stability/rigidity for cage. Particularly on cages 15mt. Majority are ok but we still get the odd lemon cage.
 more of these to prevent cage bending/moving

AREA: NAT SAT Tunnel South
 Office Wiri Precast GNRI North

DO YOU WANT FEEDBACK ON CLOSE OUT? YES NO

LEAN CONSTRUCTION EFFICIENCY CARD

IMPROVEMENT IDEA

NAME & COMPANY: Calum DATE & TIME: 2/9/13

WHAT CAN WE DO BETTER?
 Senior team double handling spiral from sawer bench.
 Discussed with Kevin C & G wheel push re directed

AREA: NAT SAT Tunnel South
 Office Wiri Precast GNRI North

DO YOU WANT FEEDBACK ON CLOSE OUT? YES NO

LEAN CONSTRUCTION EFFICIENCY CARD

IMPROVEMENT IDEA

NAME & COMPANY: Marty Tibury DATE & TIME: 2/9/13

WHAT CAN WE DO BETTER?
 Designers want Gropes used for Ramp 2 southern embankment & not general landfill as there are layers of geogrid/leaves in. Gropes → \$216. H.F. → \$92/L
 I suggest we do a Gropes layer (15mm) either side of each geogrid layer of the 1st hard fill. Geogrid in Gropes layer.
 All Gropes → \$340,000
 All H.F. → \$300,000
 Suggested Gropes → \$330,000
 Subcontractor: Waterside

AREA: NAT SAT Tunnel South
 Office Wiri Precast GNRI North

DO YOU WANT FEEDBACK ON CLOSE OUT? YES NO

This will be capture the Heavy Goods

LEAN CONSTRUCTION EFFICIENCY CARD

IMPROVEMENT IDEA

NAME & COMPANY: Mike K DATE & TIME: 6/9/13

Stores

WHAT CAN WE DO BETTER? **SAVE MONEY. WITH CHANGING A SUPPLIER FOR STORES ON PPE GEAR LONG SLEEVE VEST. TOTAL SAVINGS OF \$9.39 PER VEST x 375 = \$3521.25 SAVINGS.**
 WE ONLY PAY \$3160. —
 UNDER ANOTHER SUPPLIER WOULD HAVE ~~BEEN~~ PAID \$6,681.25.

AREA: NAT SAT Tunnel South
 Office Wiri Precast GNRI North

DO YOU WANT FEEDBACK ON CLOSE OUT? YES NO

LEAN CONSTRUCTION EFFICIENCY CARD

WASTE RECORD

NAME & COMPANY: Butcher DATE & TIME: 2/9/13

DESCRIBE THE WASTE:
 Pallets in wood skip with \$35 deposit stamped on side of pallet. Are we to return and collect \$35?

AREA: NAT SAT Tunnel South
 Office Wiri Precast GNRI North

WCA Subcontractor/Supplier

DO YOU WANT FEEDBACK ON CLOSE OUT? YES NO

LEAN CONSTRUCTION EFFICIENCY CARD

WASTE RECORD

NAME & COMPANY: Tony Kiddle WCA DATE & TIME: 3/9/13

DESCRIBE THE WASTE: (P2P)
 30 metre measuring tape was wrongly taped up. Bottom of tape was bent so it was reading 70mm shorter. When measured pile hole was short of drill depth. So drill rig had to be moved back to pile hole.

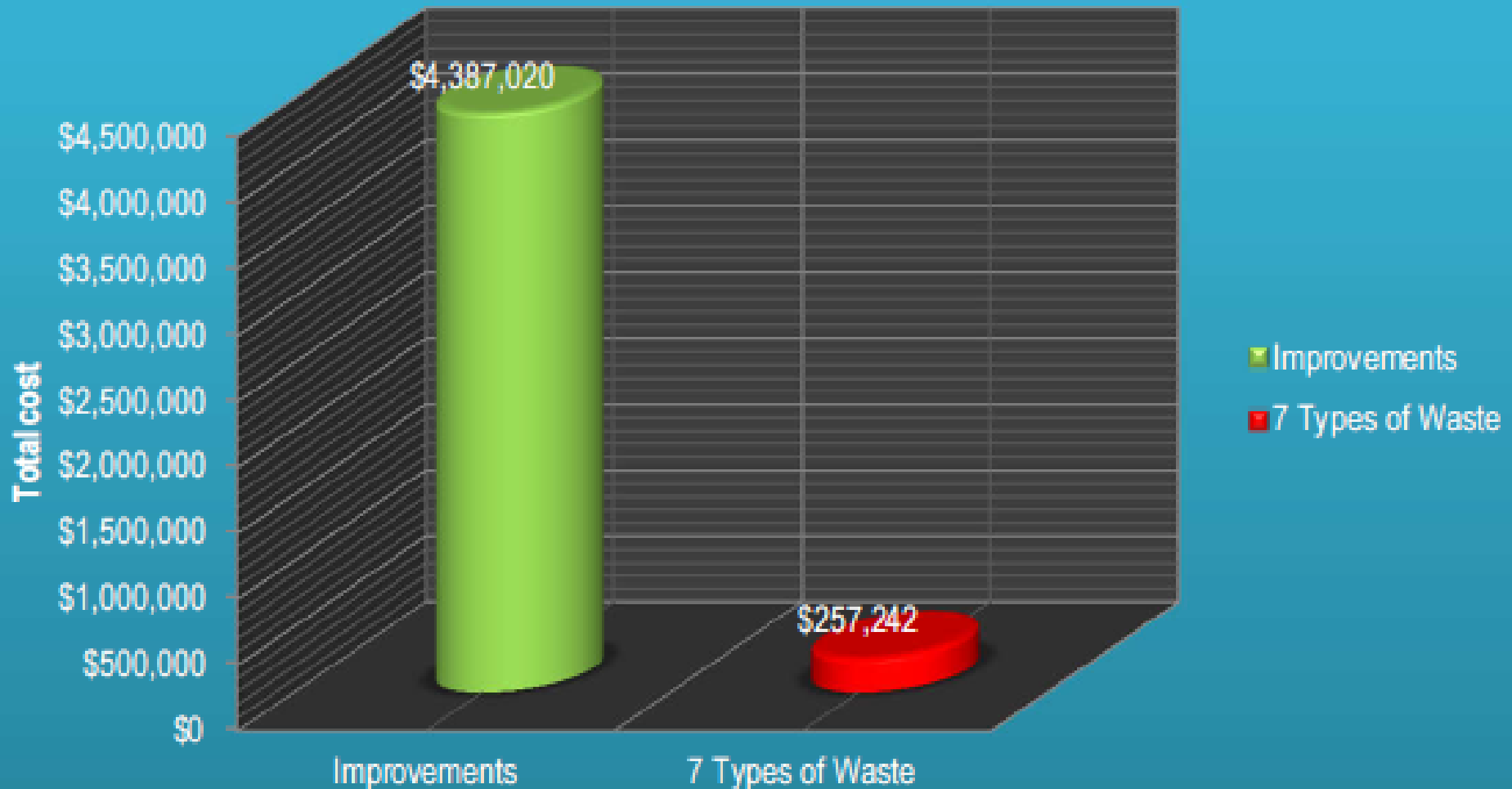
AREA: NAT SAT Tunnel South
 Office Wiri Precast GNRI North

WCA Subcontractor/Supplier

DO YOU WANT FEEDBACK ON CLOSE OUT? YES NO

Waterview Tunnel - Waste Card Analysis

Improvements VS Total Waste



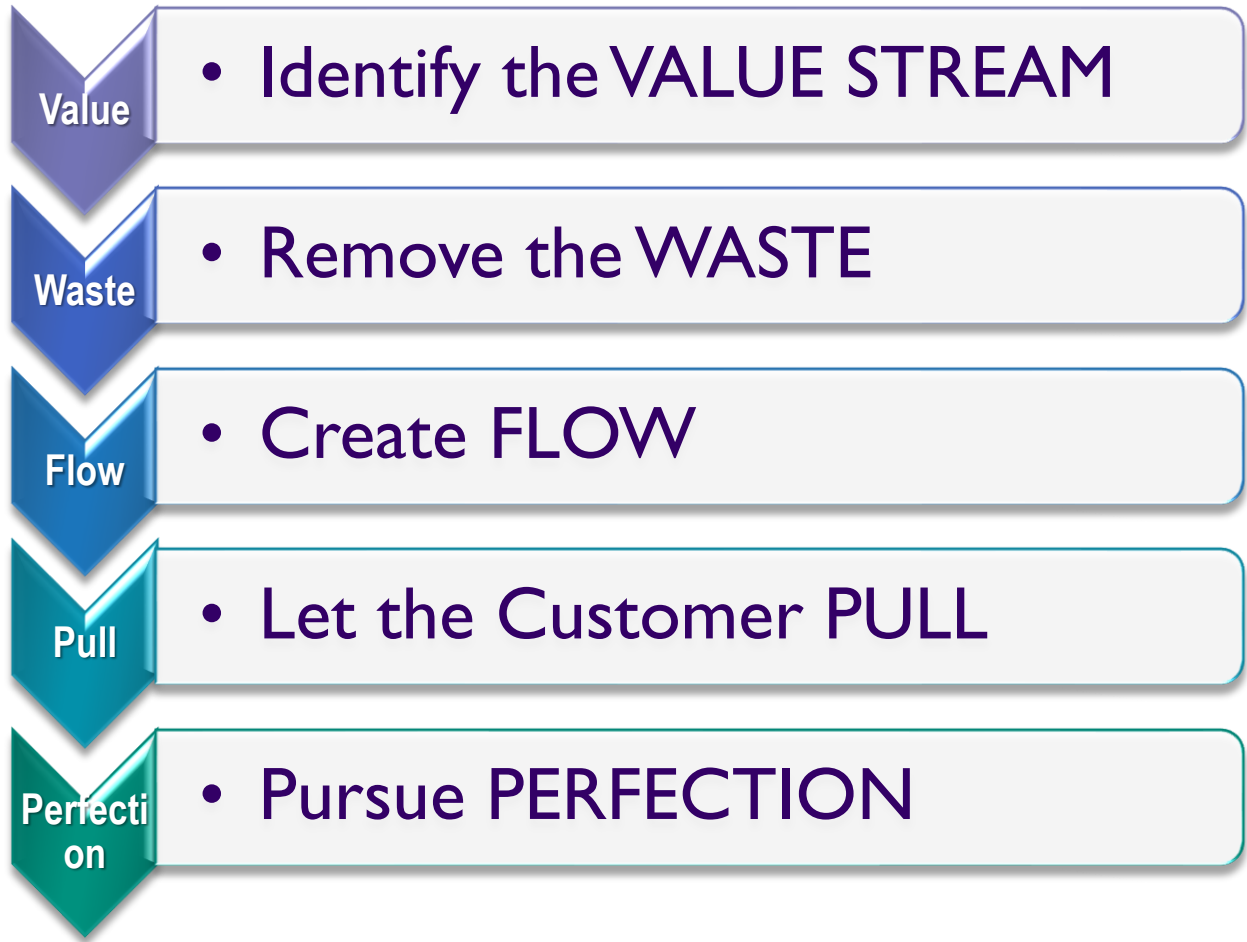


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Introduction to Lean Construction

Interactive presentation

Five Lean Principles



Value

Impeccable Coordination



Courtesy of DPR, Inc

The 7 Types of Waste (Ohno)



TIMWOOD - The Waste of...

TRANSPORT...Unnecessary Transportation haulage and double handling

INVENTORY... Unnecessary inventory storage

MOTION... Unnecessary motions travel distances

WAITING...Waiting for people, information, materials

OVERPROCESSING... Inappropriate processing wrong methods

OVERPRODUCTION... Overproduction building ahead of time

DEFECTS ...Defective work rework

plus

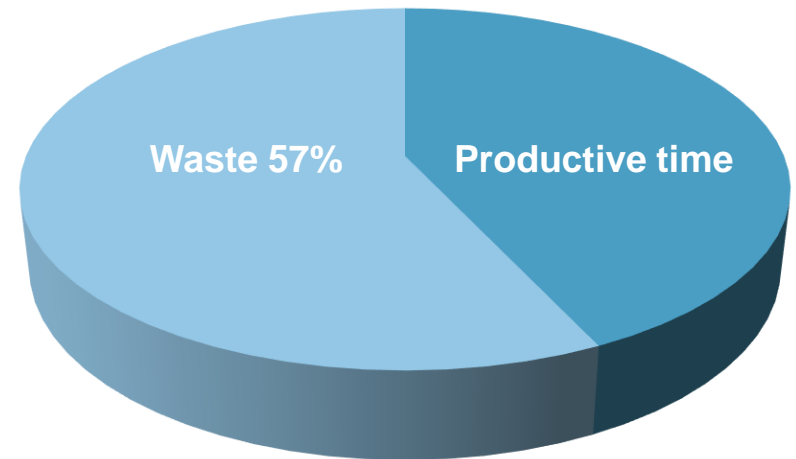
...Human potential not developing people

Soooo much Opportunity!!!

Manufacturing

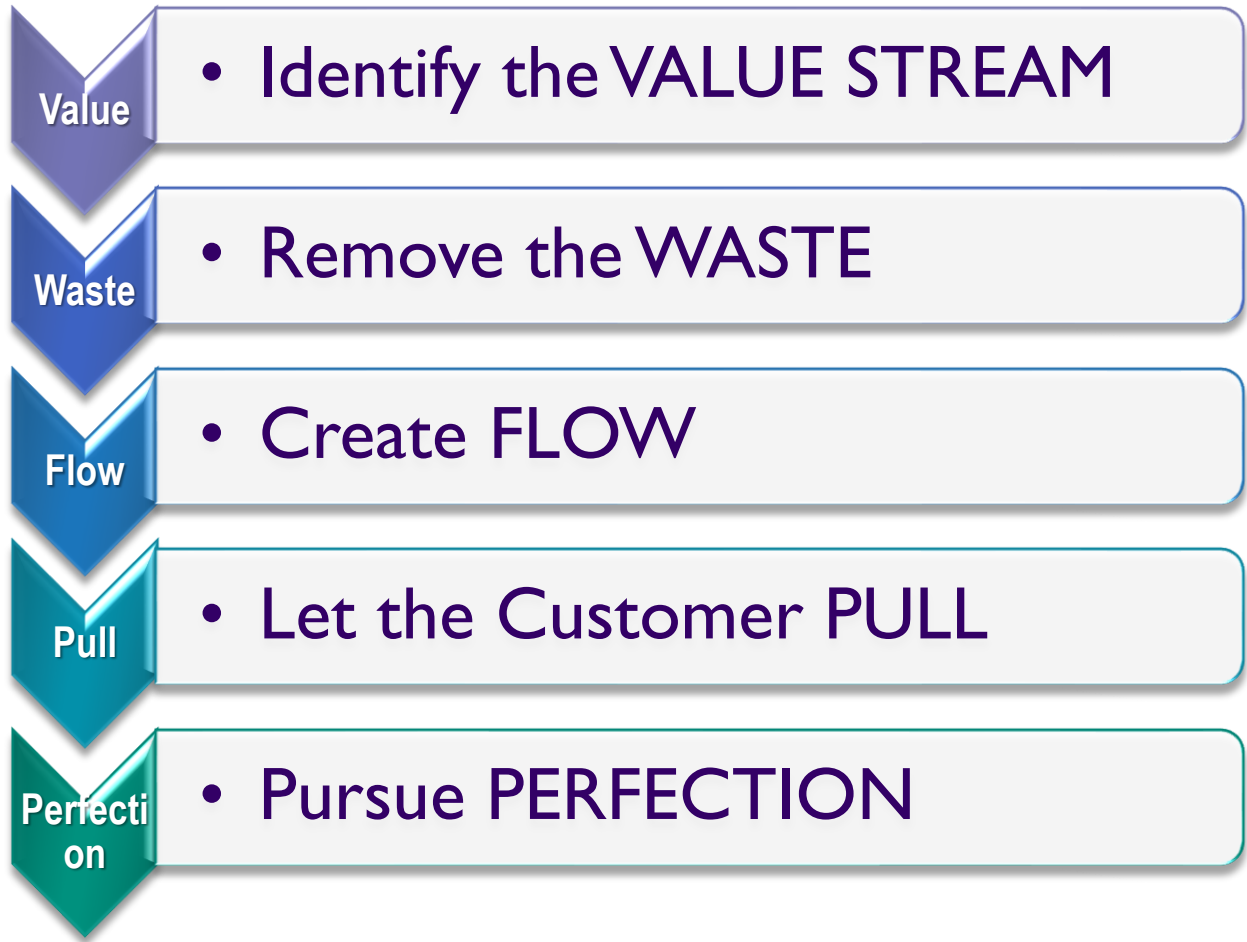


Construction



Source: Construction Industry Institute 2004

Five Lean Principles



Flow

Impeccable Flow

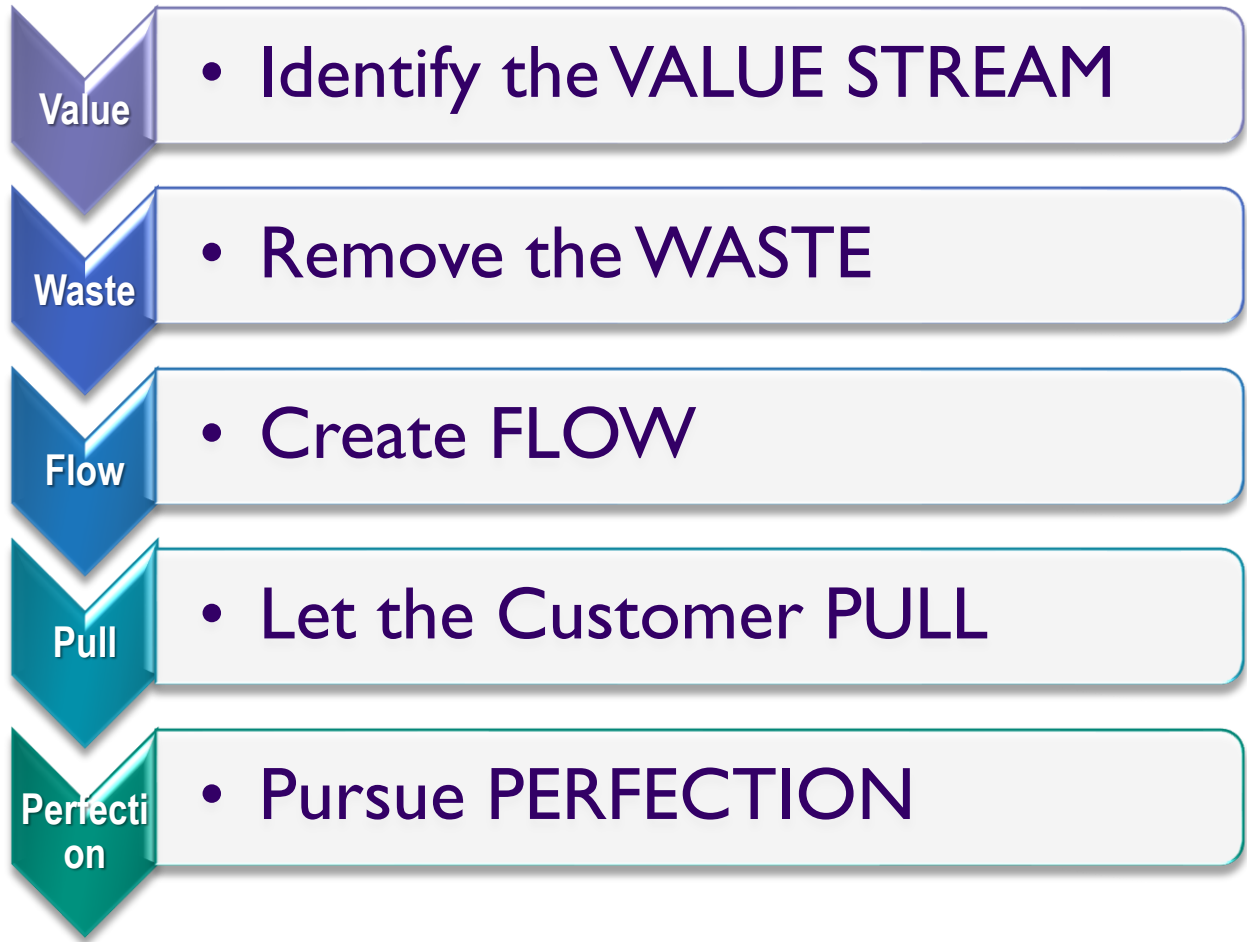


Flow

Line of Sight!

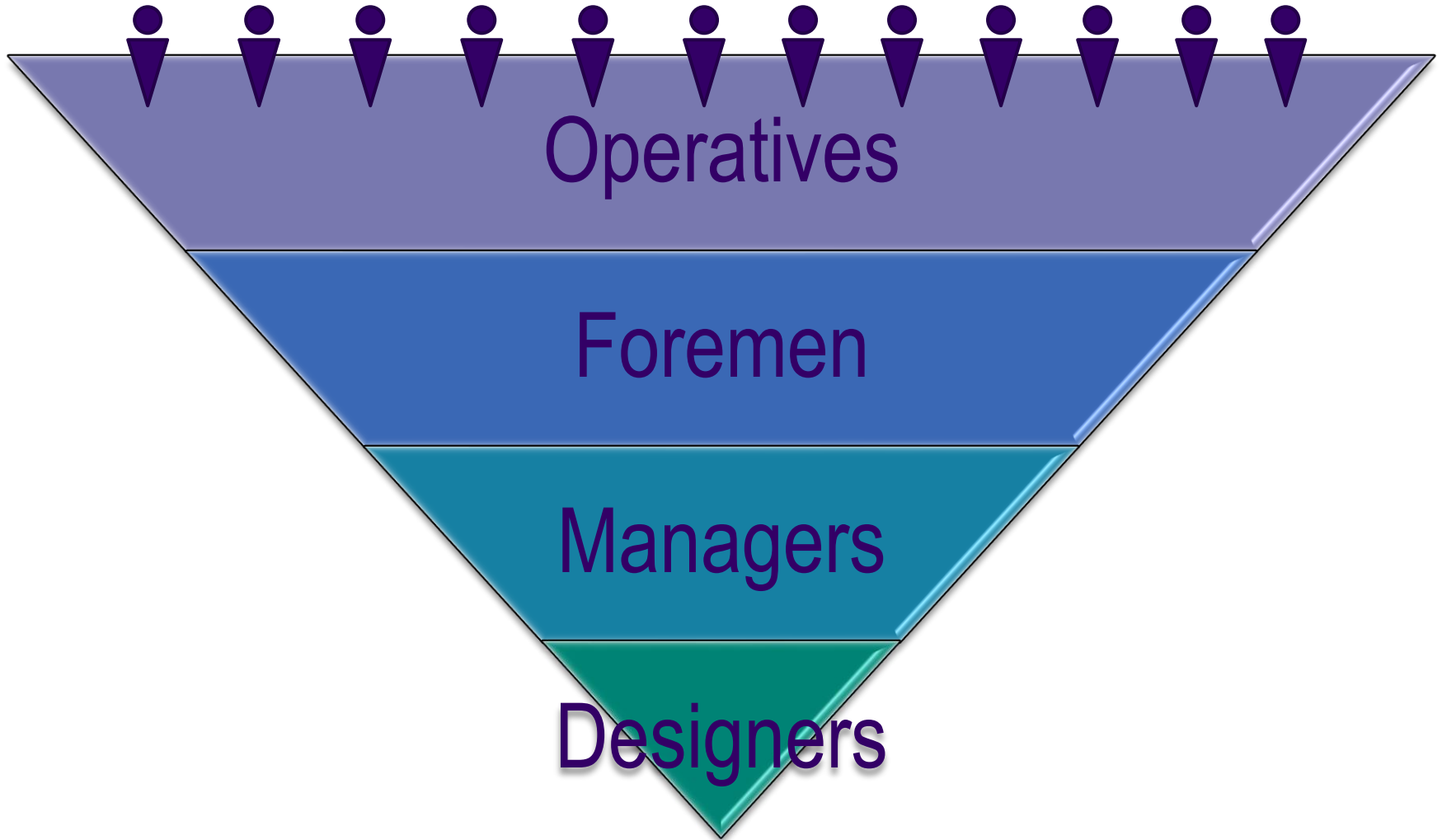


Five Lean Principles



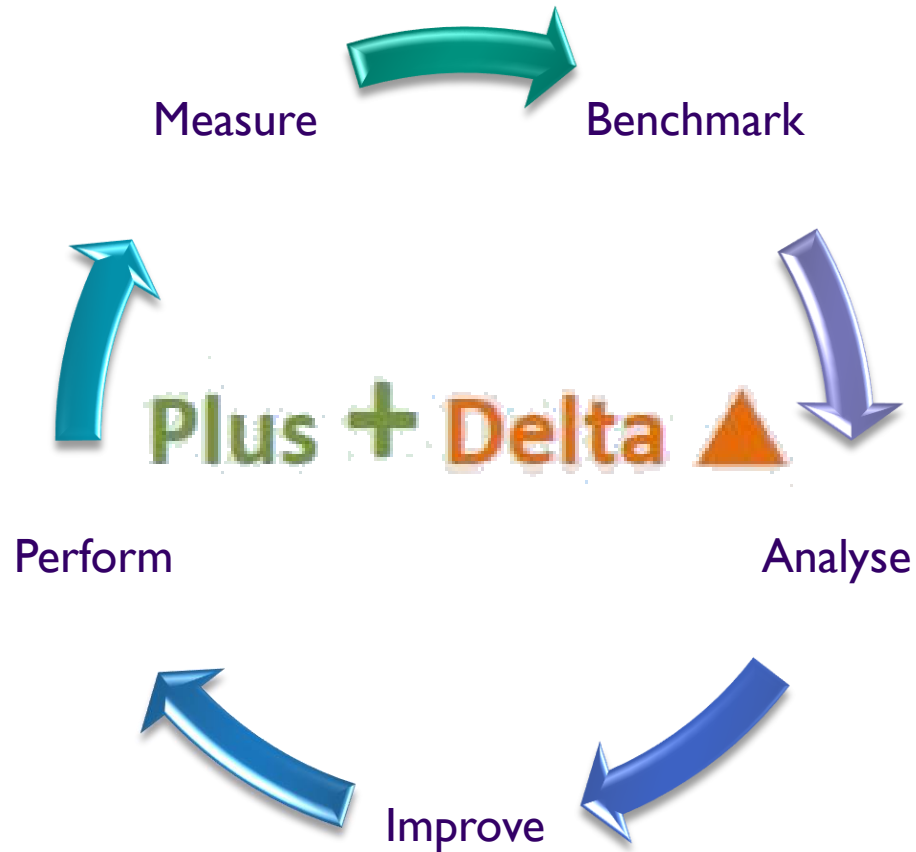


Let the Customer PULL

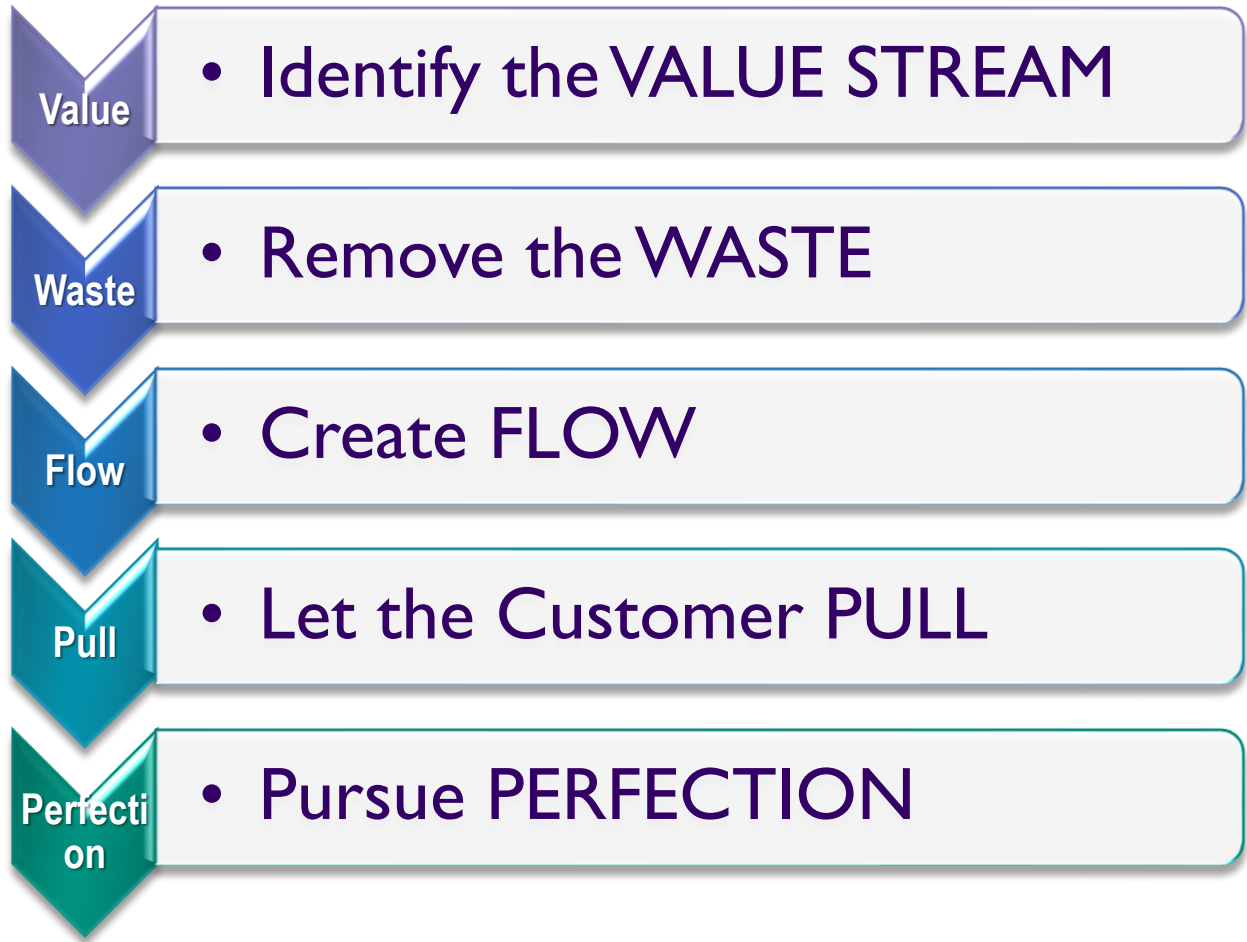


Perfection

Pursue Perfection



Five Lean Principles





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Afternoon Tea

The Airplane Game - Production Line Layout

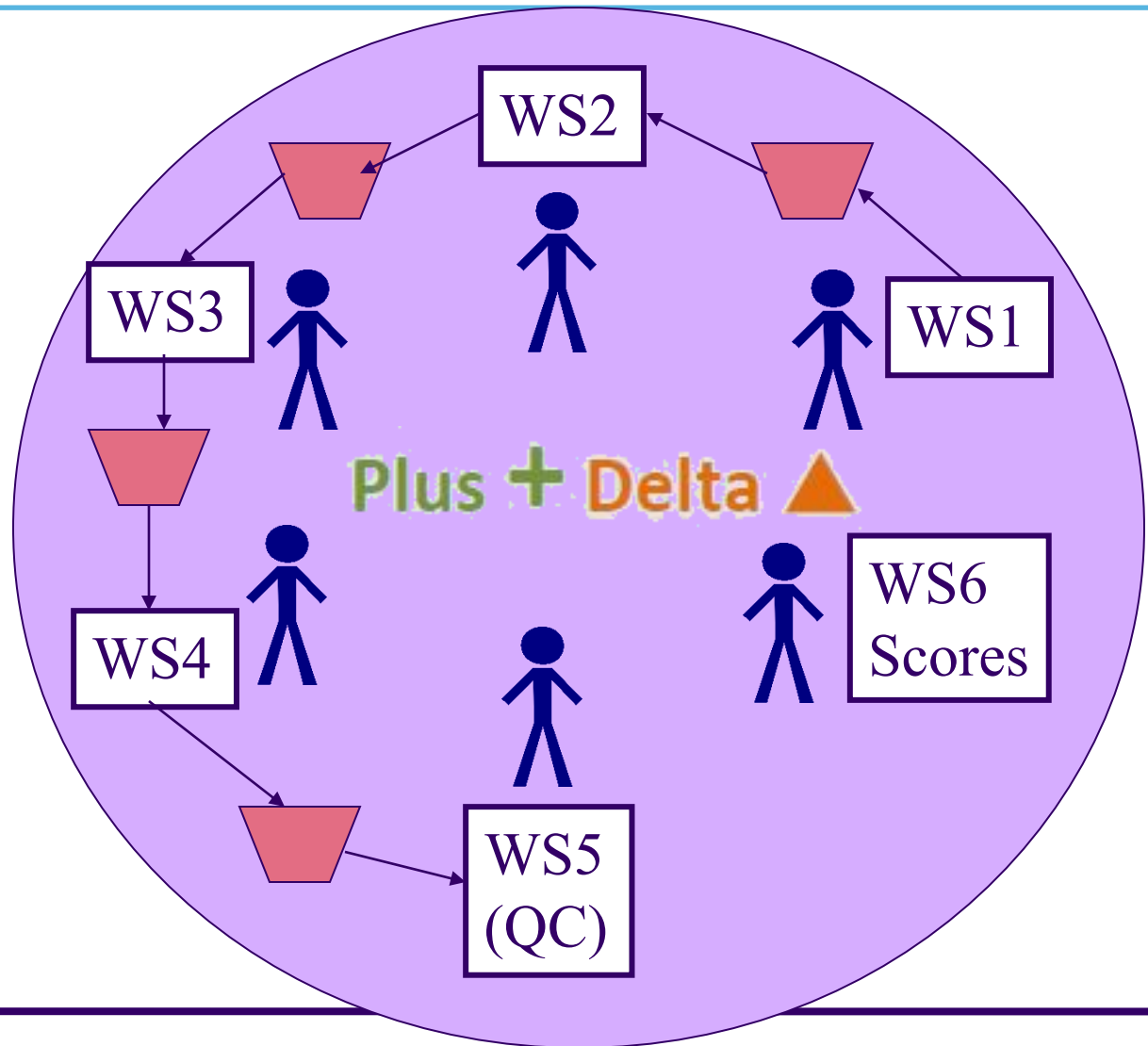
WSX Workstation

 Incoming Queues

 Rule Keeper

 Dismantler

 Observer (s)

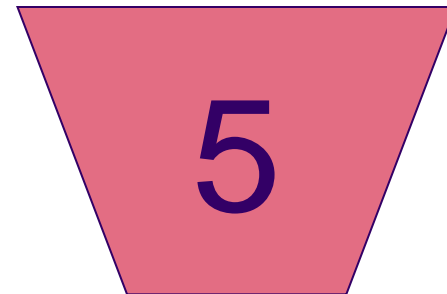


The Challenge

The most good planes in 4 minutes

Phase 1 Logistics

- ▶ Completed Batches of 5 placed in queue space of next station
- ▶ Batches remain together until final inspection



Phase 1 Policies

- ▶ Workers perform only their assigned tasks - NO THINKING
- ▶ Maintain Batch integrity - BUILD IT IF YOU CAN and PASS IT ON IF YOU CAN'T.
- ▶ QC Problems only detected by Inspector - NO FEEDBACK - NO TALKING
- ▶ All QC problems set aside as rework - TURN UPSIDE DOWN
- ▶ QC Inspector announces first good plane.
- ▶ Assemblers are paid by the piece.

Performance Metrics

- ▶ **Planes:** in each 4 minute phase.
- ▶ **Time:** to the first good plane
- ▶ **Rework:** the number of planes turned upside down
- ▶ **Work-in-Progress Inventory (WIP):** the number of sub-assemblies at end

Your Hypotheses

How many good planes do you think
you can produce?

The Airplane Game - Production Line Layout

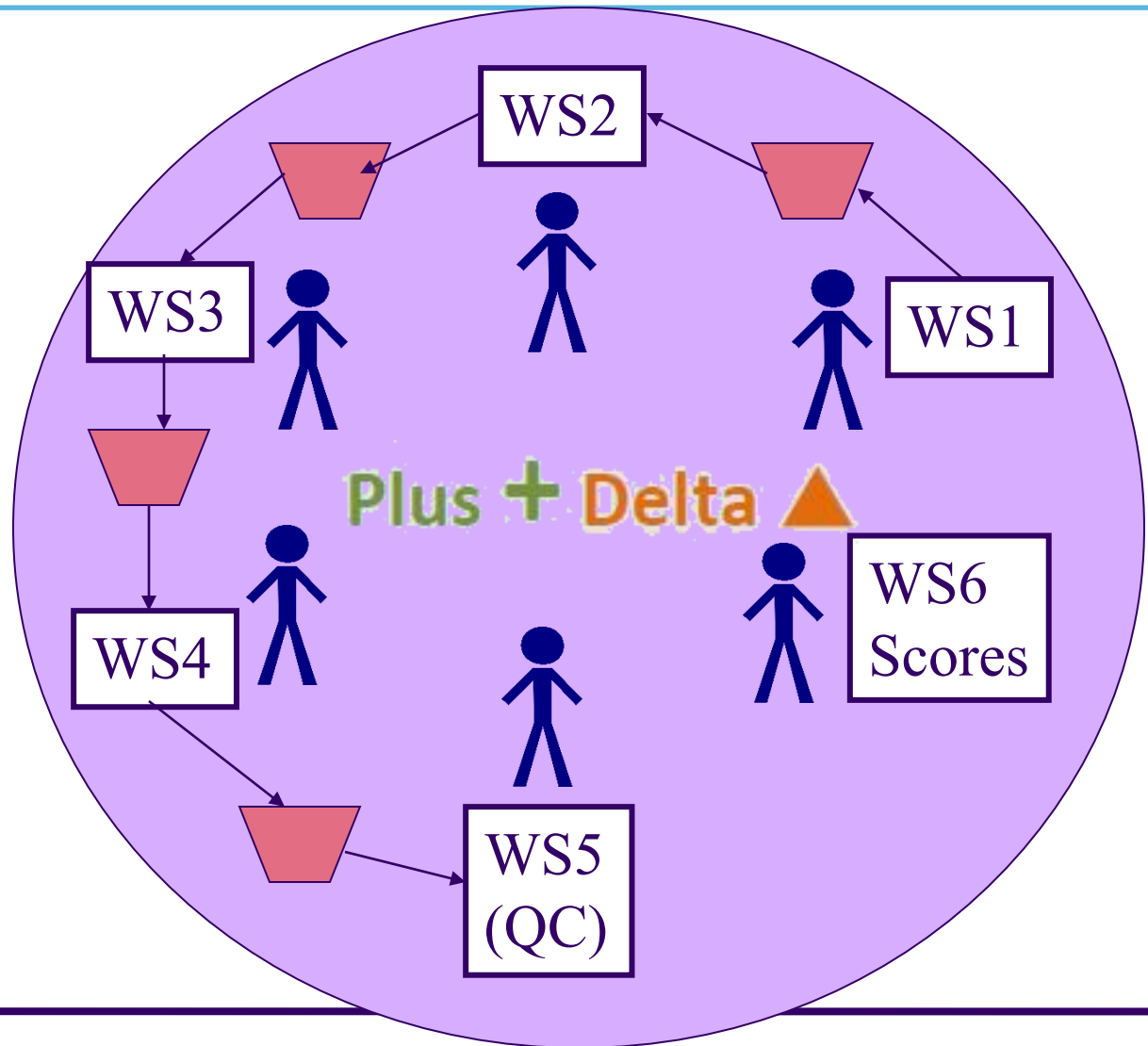
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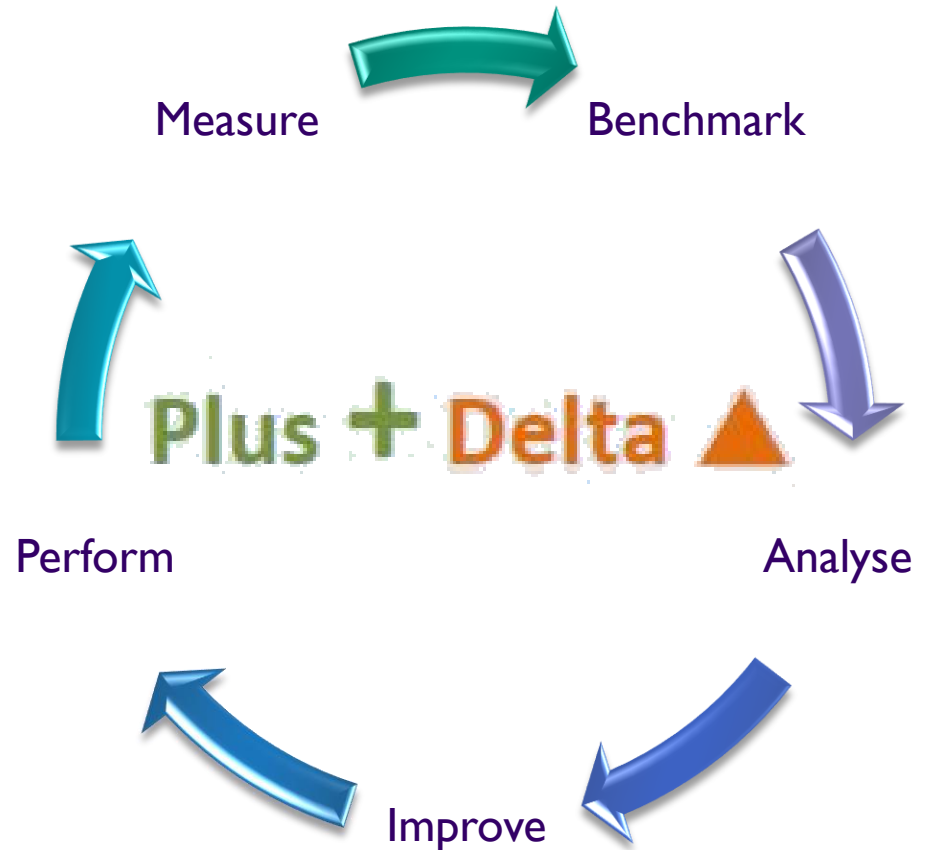
 Observer (s)



▶ Scores

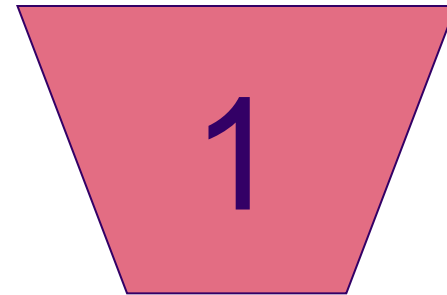
How could this system be redesigned for better performance?

1. Use Plus Delta
2. Make 3 small changes



Phase 2 Logistics

- ▶ Only one assembly at their workstation
- ▶ Only 1 assembly allowed in queue space (Batch size of 1)
- ▶ Assembly can only be placed in queue when it is **empty** (pull mechanism).



Phase 2 Policies

- ▶ QC Problems may be discussed
 - ▶ SOME THINKING and TALKING ALLOWED
- ▶ All QC problems set aside as rework at station discovered.
 - ▶ TURN UPSIDE DOWN
- ▶ Hourly wages plus a bonus for team performance.
- ▶ Workers perform only their assigned tasks
- ▶ Workers cannot fix QC problems from upstream
- ▶ Inspector announces first good plane.

Your Hypotheses

How many good planes do you think
you can produce?

The Airplane Game - Production Line Layout

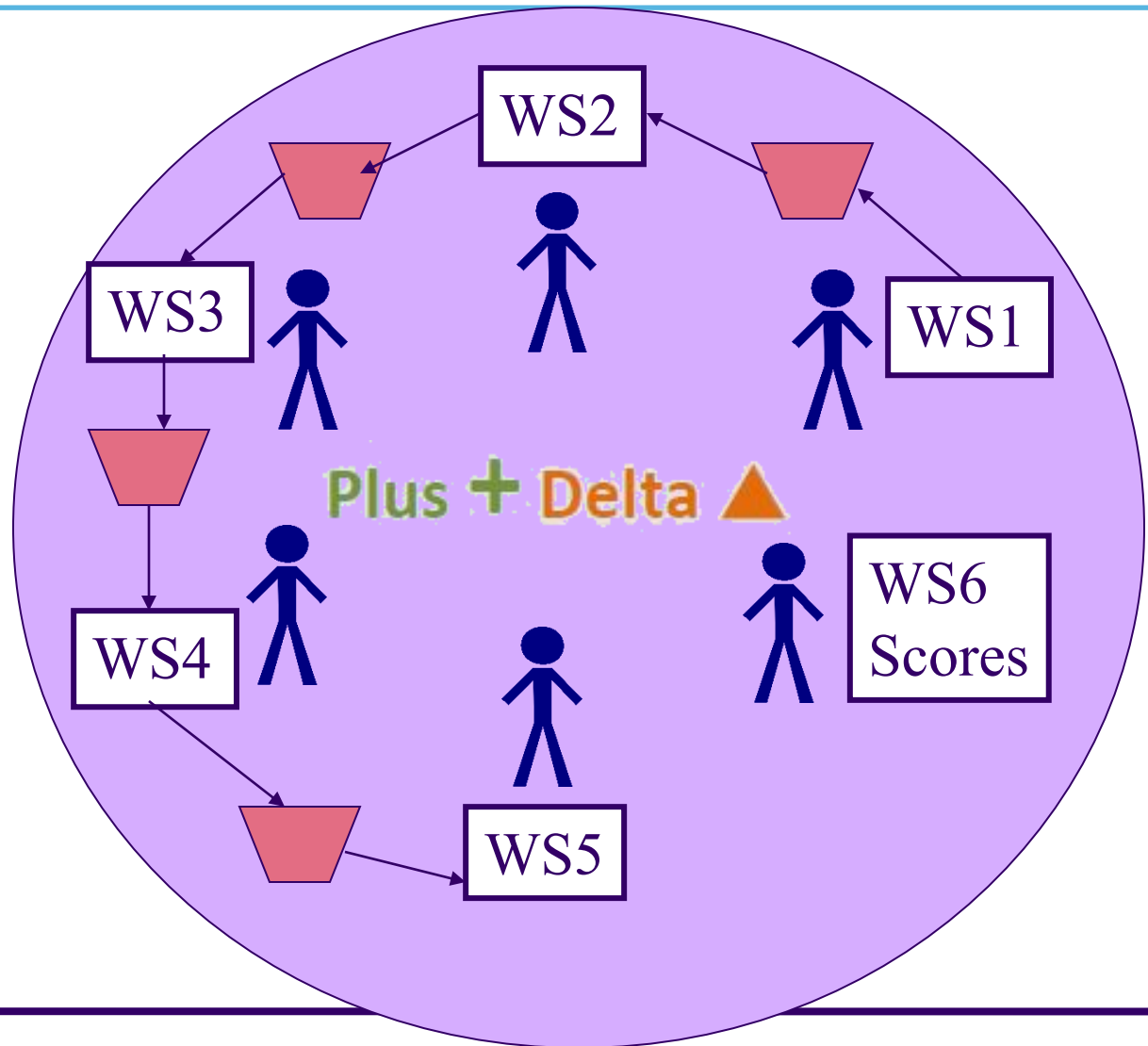
WSX Workstation

 Incoming Queues

 Rule Keeper

 Dismantler

 Observer (s)



▶ Scores

Phase 3 Logistics

- ▶ Use Green Phase 3 Instruction Sheets.

Phase 3 Policies

- ▶ Workers perform ANY step in the production process.
- ▶ QC problems can be fixed by any worker - Fix it when you find it.
- ▶ No restrictions on talking.

The Airplane Game - Production Line Layout

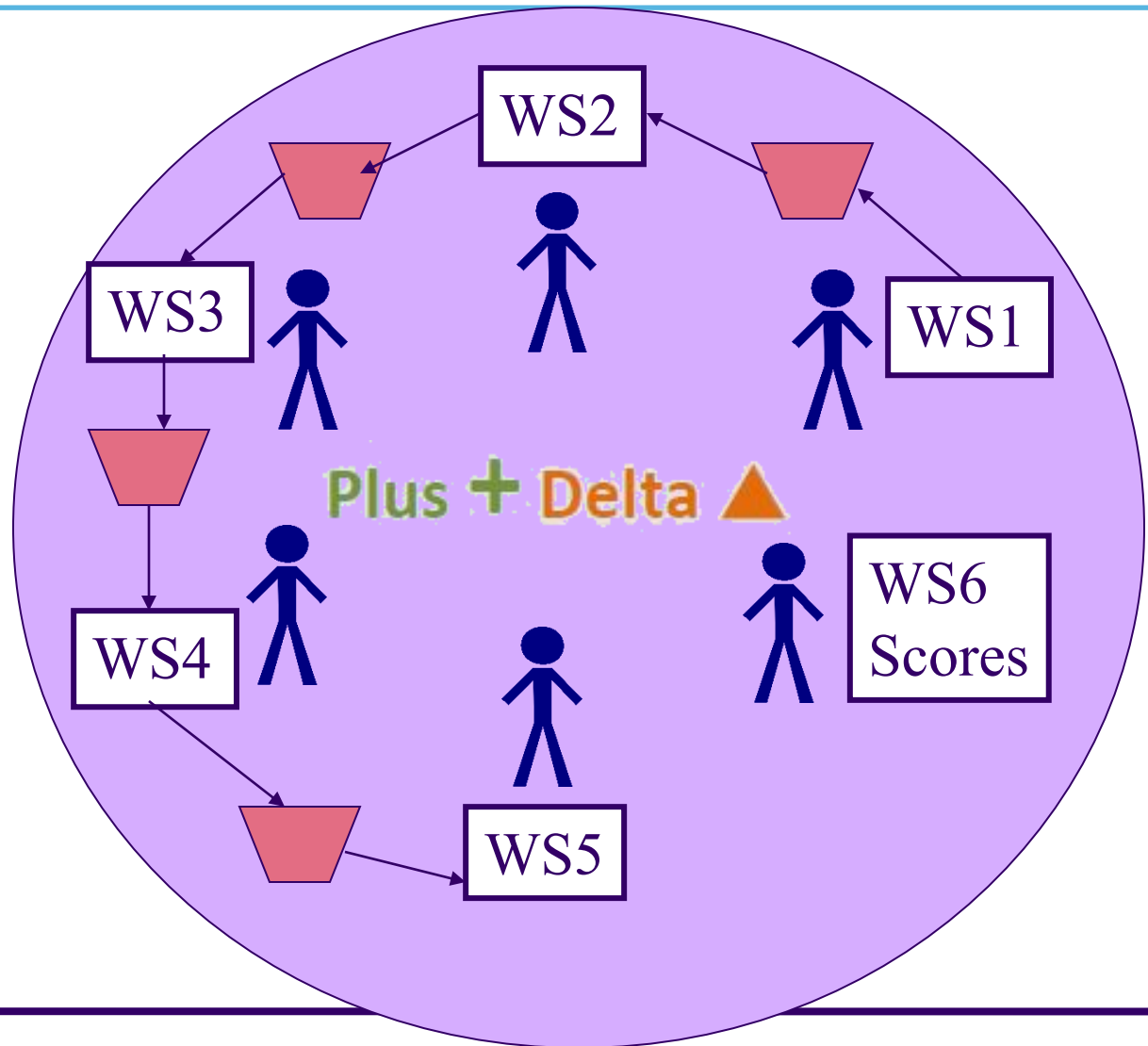
WSX Workstation

 Incoming Queues

 Rule Keeper

 Dismantler

 Observer (s)



▶ Final Scores & discussion



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The Last Planner System™

Workshop

Villego round 1

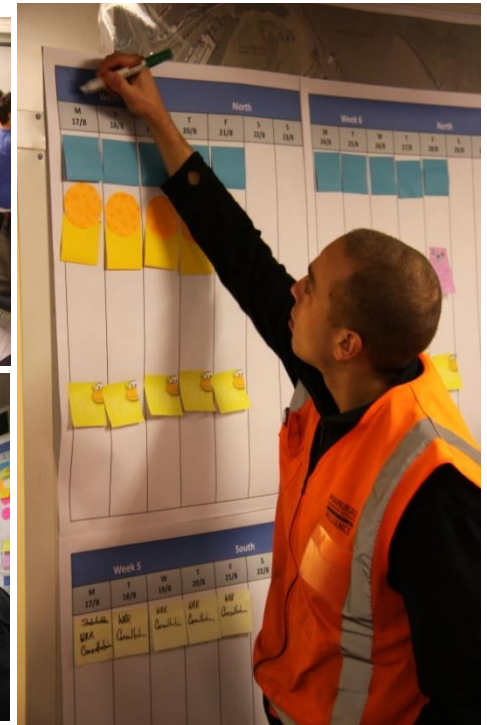


Typical Villego Results

	R 1	R 2
Construction time	30:0*	8:4
Productivity (elements/minute)	3.40	12.64
Subcontractor time on site	635	48
Errors in building	76	0
Safety penalties	1	1
Penalties for reuse of materials	0	0
Waste (in studs)	153	0
Profit/loss	-1865k	84k

The Five Steps of Last Planner

- ▶ 1. Collaborative programming
 - ▶ Building programmes to suit YOUR constraints
 - ▶ Creating Flow
 - ▶ Removing Waste
 - ▶ Creating Conversations



The Five Steps of Last Planner

- ▶ 1. Collaborative Programming
- ▶ 2. Making Ready
 - ▶ Make Ready Planning (5 week Look ahead)
 - ▶ Removing Constraints (Bottlenecks)
 - ▶ Can Do



The Five Steps of Last Planner

- ▶ 1. Collaborative Programming
- ▶ 2. Making Ready
- ▶ 3. Production Planning
 - ▶ Impeccable Coordination
 - ▶ Flow at the 'Gemba' (workface)
 - ▶ 1 hr Weekly Production Mtgs



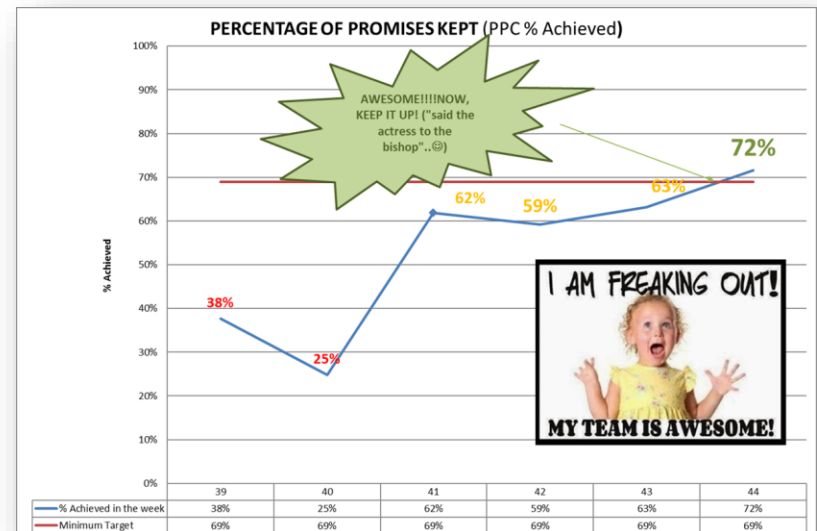
The Five Steps of Last Planner

- ▶ 1. Collaborative Programming
- ▶ 2. Making Ready
- ▶ 3. Production Planning
- ▶ 4. Production Management
 - ▶ Daily Scrum!
 - ▶ Declaring 'Done Done'
 - ▶ 'Pull' where can



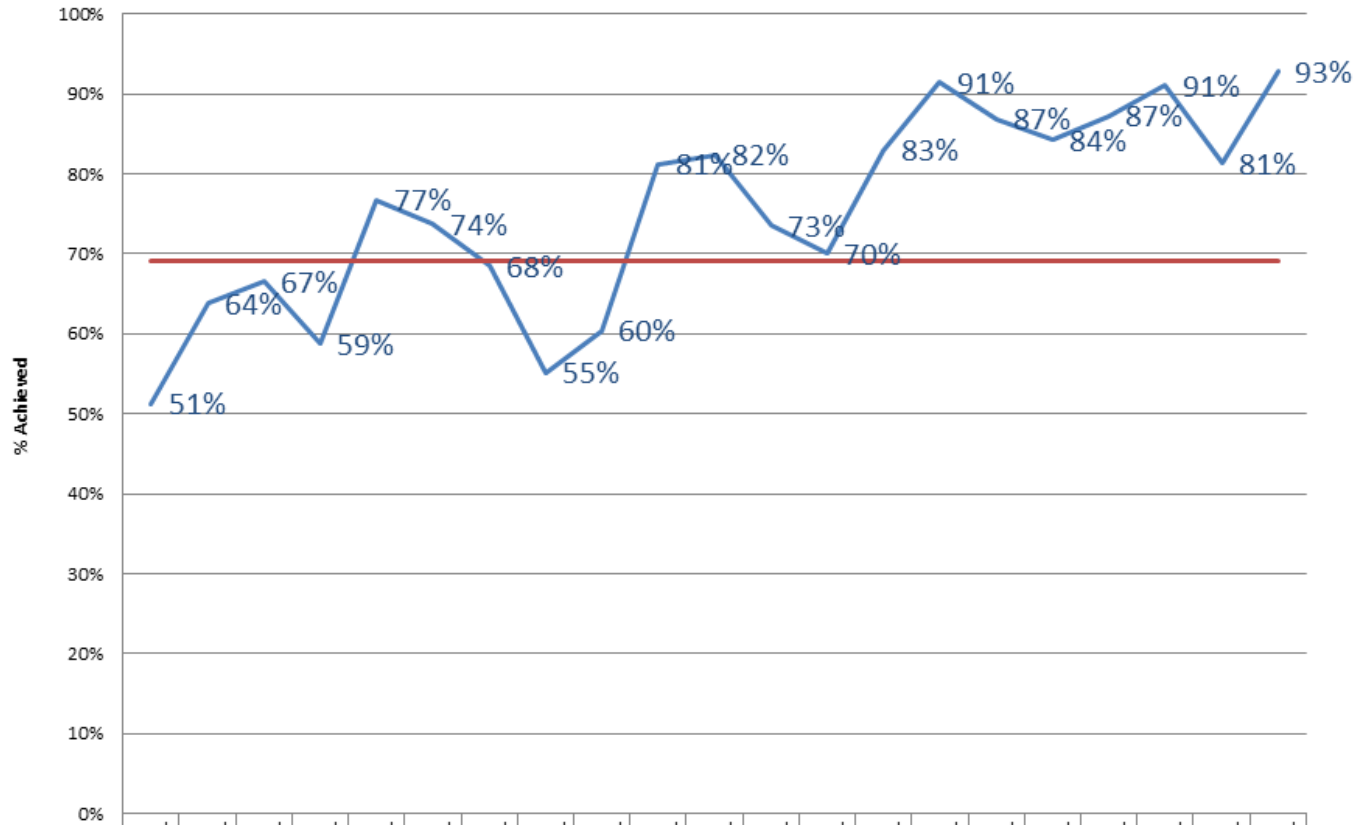
The Five Steps of Last Planner

- ▶ 1. Collaborative Programming
- ▶ 2. Making Ready
- ▶ 3. Production Planning
- ▶ 4. Production Management
- ▶ 5. Learning & Improving
 - ▶ Weekly PPC scores
 - ▶ Reasons for Zero
 - ▶ % Can Do Tasks (Made Ready)
 - ▶ +▲
 - ▶ Cause Countermeasure



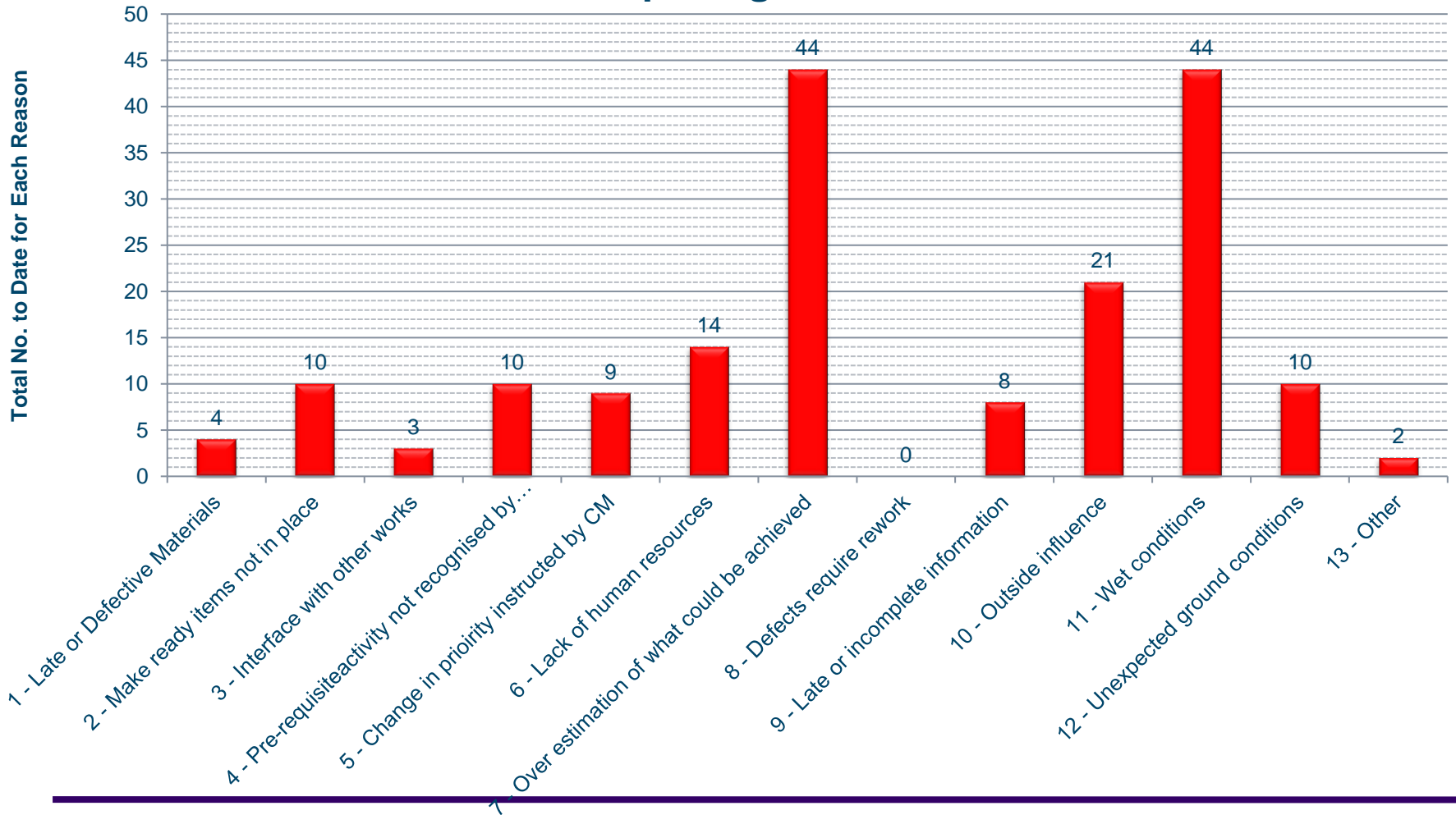
Last Planner Overview – Waterview PPCs

PPC % Achieved



— % Achieved	51%	64%	67%	59%	77%	74%	68%	55%	60%	81%	82%	73%	70%	83%	91%	87%	84%	87%	91%	81%	93%
— Minimum Target	69%	69%	69%	69%	69%	69%	69%	69%	69%	69%	69%	69%	69%	69%	69%	69%	69%	69%	69%	69%	69%

Reasons for Not Completing WWP Task - Total to Date



Last Planner Overview

- ▶ What are the benefits?
 - ▶ Mitigate Delays
 - ▶ Get projects 'back on track'
 - ▶ fosters an enjoyable environment of Trust, Openness & Honesty
 - ▶ Improved communication
 - ▶ Keep regular track on profit
 - ▶ Make a fair & reasonable profit
 - ▶ Understand the risks before they 'get you'
 - ▶ Grow a winning team for future



Last Planner Overview

- ▶ When would you use Last Planner?
 - ▶ Projects that are in delay
 - ▶ Large, complex projects
 - ▶ Small projects



It is never too late to introduce LP principles.

Q&A?

