



LEAN Analysis and maintenance optimisation

Improving business performance

Companies facing increasing competition or other external pressures frequently implement established methods for improving business performance

Three of the most commonly applied tools are:

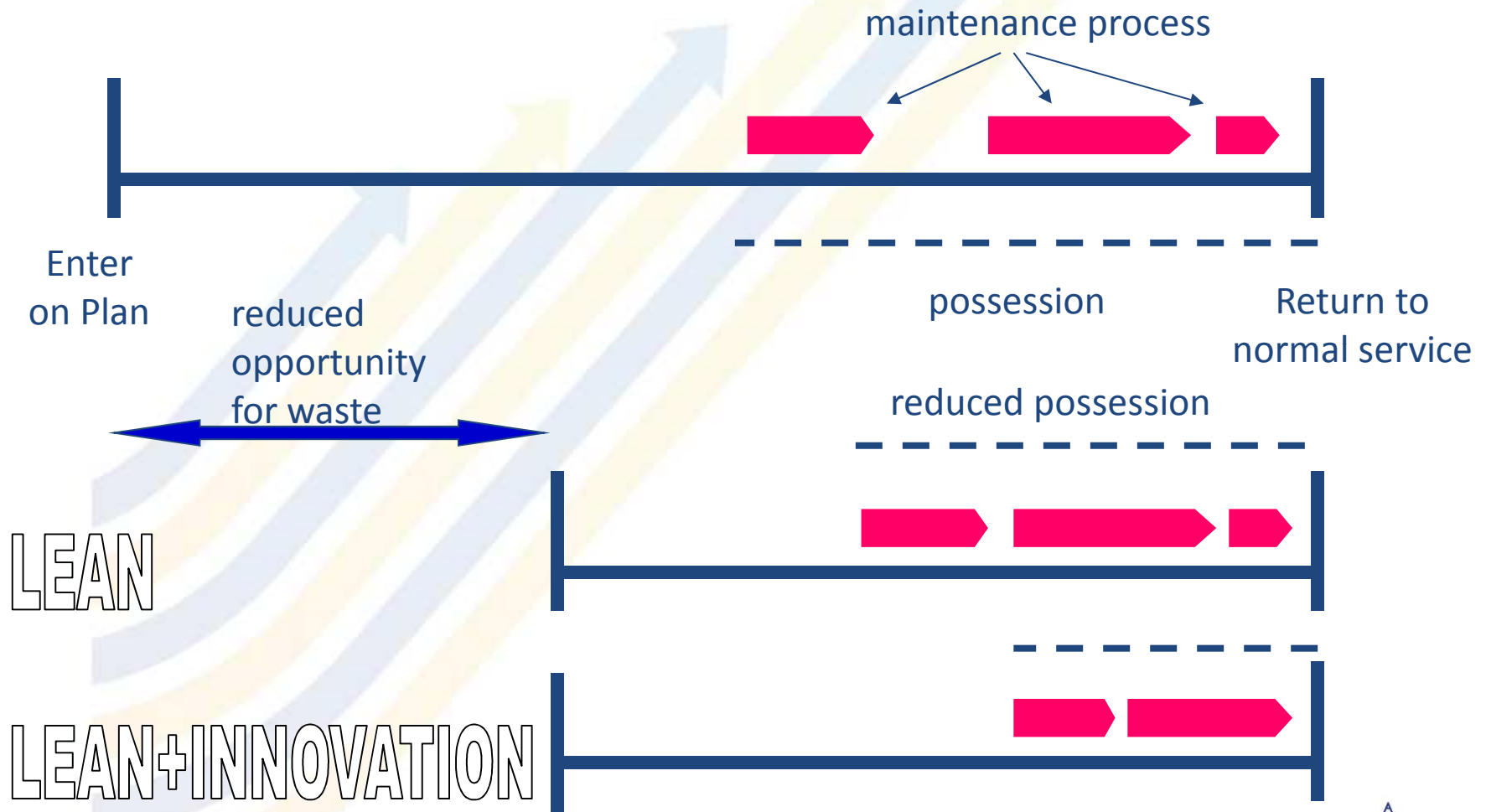
- o **Six Sigma**
- o **Theory of constraints**
- o **Lean**

Why did AUTOMAIN selected Lean rather than another or a combination of all three?

Although there are similar characteristics in these techniques, key defining differences are

- o Six Sigma (6σ)
 - o problem-focused, with a view that process variation is waste.
 - Improved performance through statistical methods (SPC)
- o Theory of Constraints (ToC)
 - o Understanding the weakest link (bottleneck) in the process chain
- o Lean
 - o Elimination of all forms of waste – over processing, time, resources etc

Lean plus innovation delivers greatest benefit



The approach

- o to undertake *Structured Observations* of the maintenance process
- o to map out the maintenance and planning processes during *Value Stream Mapping* (VSM) workshops, quantification of key parameters wherever possible (the duration of the task, the manpower required, the probability of each step occurring right first time etc.)
- o to produce a *Hand Off Diagram*

Lean provides an opportunity to re-connect management with what is happening at ground level

Structured Observations

Key timings and observations were recorded, and the utilisation of time was subsequently broken down into 5 generic tasks:

- o confirmation = confirming granting of possession
- o waiting = waiting for equipment to arrive
- o communication = phone calls and creation of documentation
- o tamping = carrying out the tamping activity
- o transportation = moving of tamping equipment to location

This information was then presented in graphical format, along with a summary of the observations made during the course of the visit.

Findings – Structured Observations

Shift utilisation (how the tamping crews spent their time)

o confirmation	6% to 15%
o waiting	7% to 25%
o communication	1% to 10%
o transportation	17% to 21%
o tamping	42% to 50%

–a recording run prior to tamping accounted for 9% of the Network Rail possession

–the SNCF, Trafikverket and ProRail maintenance was targeted at *specific locations* within the possession, whereas the Network Rail and DB maintenance was undertaken on a *continuous length* of track

–the number of concurrent processes was different between administrations which potentially increases productivity at the cost of extra manpower and possibility of conflicts

Possession Utilisation

Break down of time utilisation during a planned 6 hour possession on 12/09/2011

	Total	NVA - Non-Value Added (Waste)	NNVA - Necessary Non-Value Added	VA - Value Added
Totals (Minutes)	360	176	34	
1. Waiting - Granting of Possession	45	45		
2. Waiting - Arrival of Tamper				
3. Pre-shift Brief				
4. Tamping Machine Set Up				
5. Carry out 'Recording Run' 1,600 M				
6. Review 'Recorded Data' and Set up T				
7. Tamping Operation				
8. Set Tamper to Travel Positions				
9. Check				
10. Pap				
11. Wait				
12. Tam				
13. Unu				

Utilisation of Available 'Possession Time'

12. Tamper 'Sweep the possession' (approx - not)

11. Wait

13. Unutilised time

Waiting - Granting of Possession

2. Waiting - Arrival of Tamper

3. Pre-shift Brief

4. Tamping Machine Set Up

5. Carry out 'Recording Run' 1,600 M

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'a' and
per

59% of the Possession spent on Non Value Added tasks

Objective:

Identify the reasons – Why?



Tamping Process – Value Stream Map



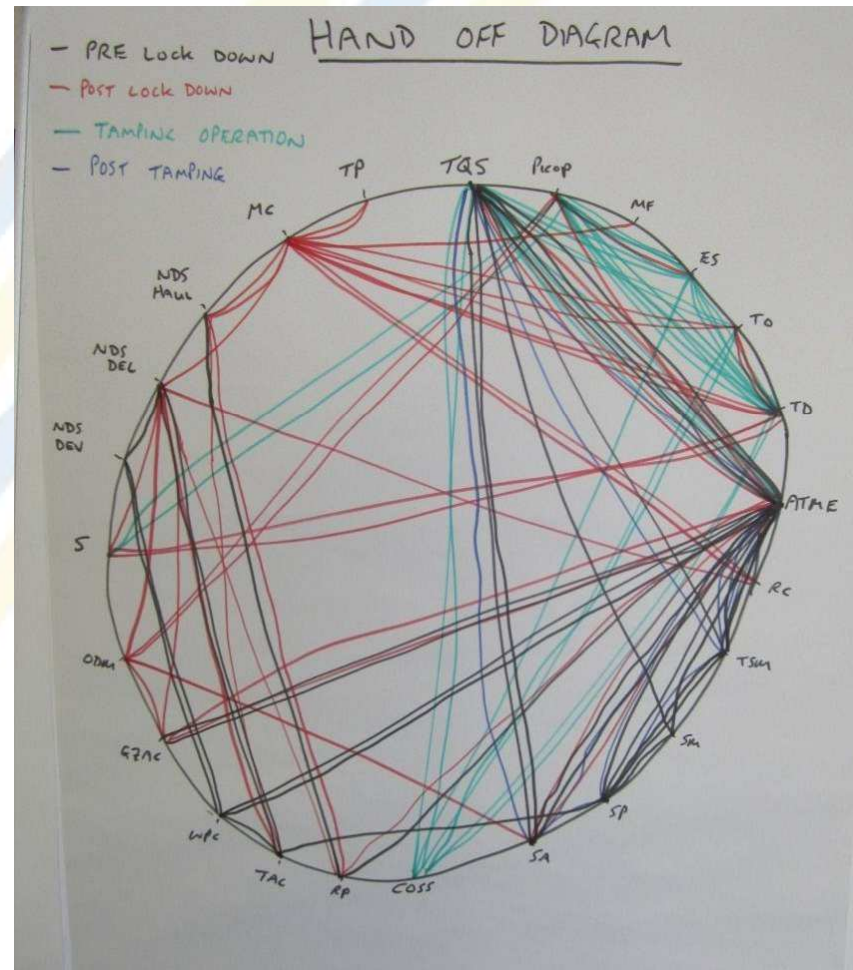
Concerns and Improvement
Ideas collected from all
AutoMain Tamping Experts



Hand-Off Diagram

ROLES

TQS - TRACK QUALITY SUPERVISOR
 COSS - CONTROLLER OF SITE SAFETY
 ATME - ASSISTANT TRACK MAINTENANCE ENGINEER
 WS - SIGNALMAN
 PICOP - PERSON IN CHARGE OF POSSESSION
 MF - MACHINE FITTER
 ES - ENGINEERING SUPERVISOR
 TO - TAMPER OPERATOR
 TD - TAMPER DRIVER
 RC - ROUTE CONDUCTOR
 TSM - SECTION MANAGER (TRACK)
 SM - SECTION MANAGER (OTHER)
 SP - SECTION PLANNER
 SA - SECTION ADMINISTRATOR
 RP - RESOURCE PLANNER
 TAC - TRACK ACCESS COORDINATOR
 WPC - WORK PLAN COORDINATOR
 GRAC - GREEN ZONE ACCESS COORDINATOR
 ODM - OPERATIONS DELIVERY MANAGER
 NDS DEV - NDS DEVELOPMENT TEAM
 NDS DEL - NDS DELIVERY TEAM
 NDS HAUL - NDS ENGINEERING HAULAGE
 MC - MACHINE CONTRACTOR
 TP - TRAIN PLANNING



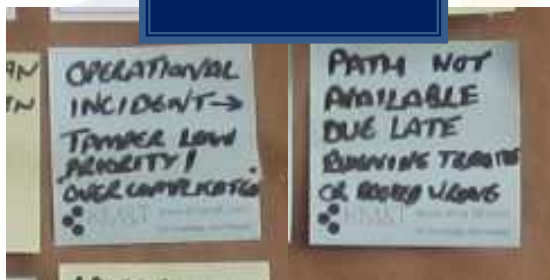
Tamping Process – Value Stream Map

Value Stream Map completed for all 5
Automain Partner Organisations

Tamping Process – Opportunities Stratified

No	Concern	Improvement Idea	Network Rai	SNCF	Strukton (Sweden & Holland)	Deutsche bahn	Category	Effort	Benefit	Rank
114	Tamper given low priority if there is an operational incident		X				Standard Planning Procedures	H	L	0
115	Tamper transit route sometimes blocked by late running trains		X	X			Problem and Countermeasure	L	H	3
116	Mismatched understanding of plan between PICOP and Signaller		X				Training and Communication	L	H	3
117		Create access points closer to regularly used signals	X				Infrastructure Development	H	H	2
118	Planners don't take account of location of signals in relation to access points		X				Standard Planning Procedures	L	H	3
119	Auto PLB at standard b		X						H	3
120		Stop using Detonators and PLB - Use 'Signal Protection' only	X						H	3

IN:
Ideas
Recorded



OUT:

- Categorisation
- Evaluation
- Project Stream Definition

Causation Factors

Why – 59% Non Value Added Tasks
Stratified

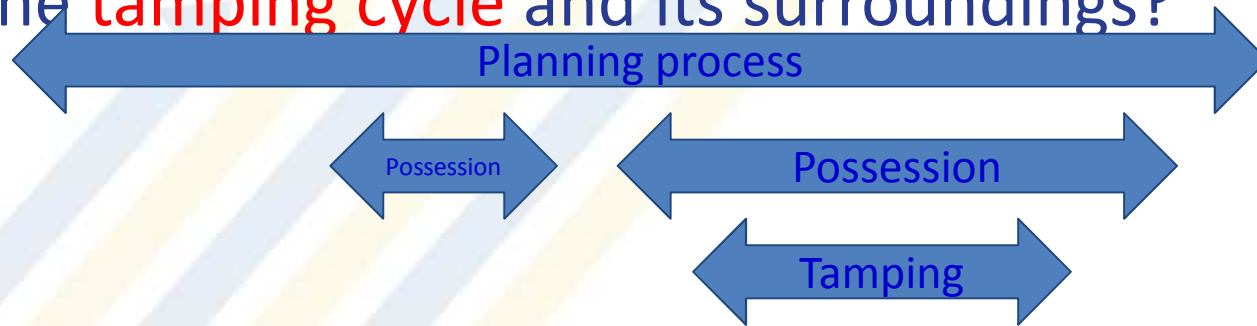
7 High Level Project Streams Identified

Waste: (non) Value Added

<u>Work Type</u>	<u>Description</u>	<u>Rail Infrastructure Example</u>	<u>Target Action</u>	<u>Image</u>
Value Added Work (VA)	Value-added is any process that changes the nature, shape or characteristic of the product in line with the customers' requirements.	1. Final torque applied to bolts in a switch	OK - No Action 	
		2. Tamping Sleepers to align track geometry (Tamper Contact Time)		
		3. Worn Track Replaced		
Necessary Non-Value Added (NNVA)	Non value-added is any work that is necessary because of current conditions but does not increase the value of the product.	1. Pick up bolt and temporary fit in to switch	Reduce 	
		2. Duration transferring tamping spines between sleepers		
		3. Transporting the new track to the work zone		
Non-Value Added Work - Waste (NVA)	Waste is all unnecessary work	1. Cannot find bolt - have to search for it prior to temporary fit in to switch.	Eliminate 	
		2. Waiting to start tamping operations		
		3. Transporting too little track - have to go and fetch some more		

Use of Lean Analysis in Automain

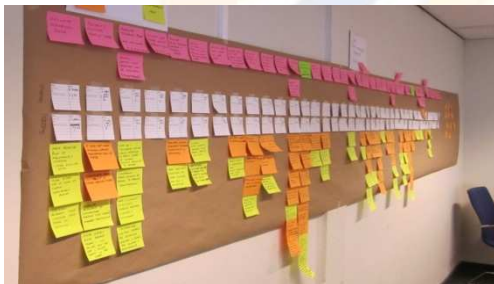
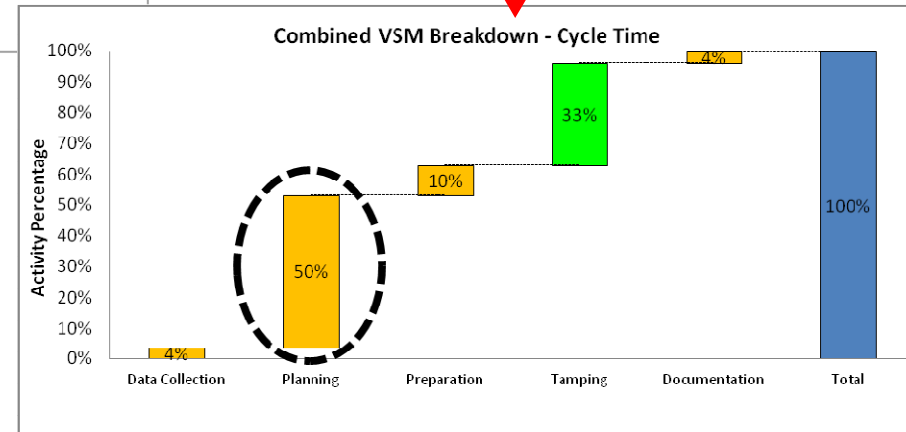
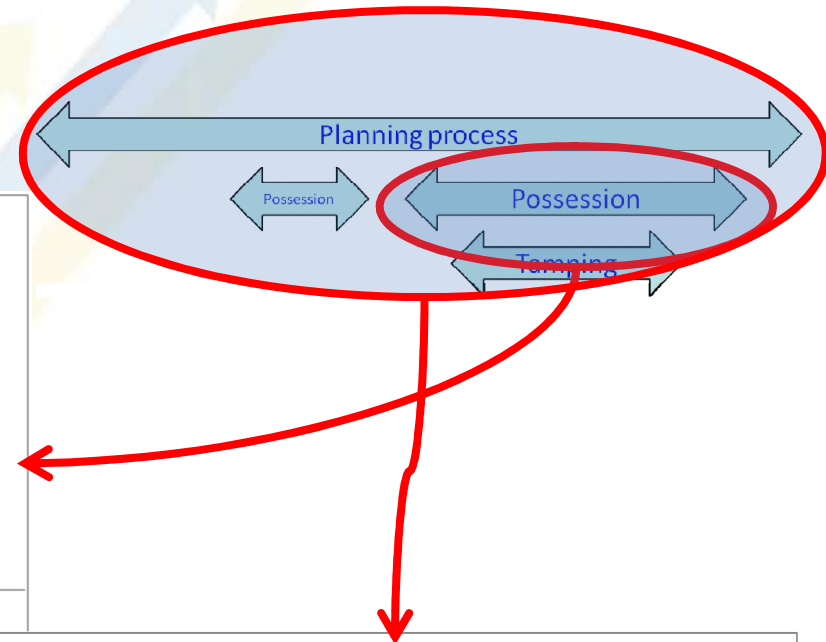
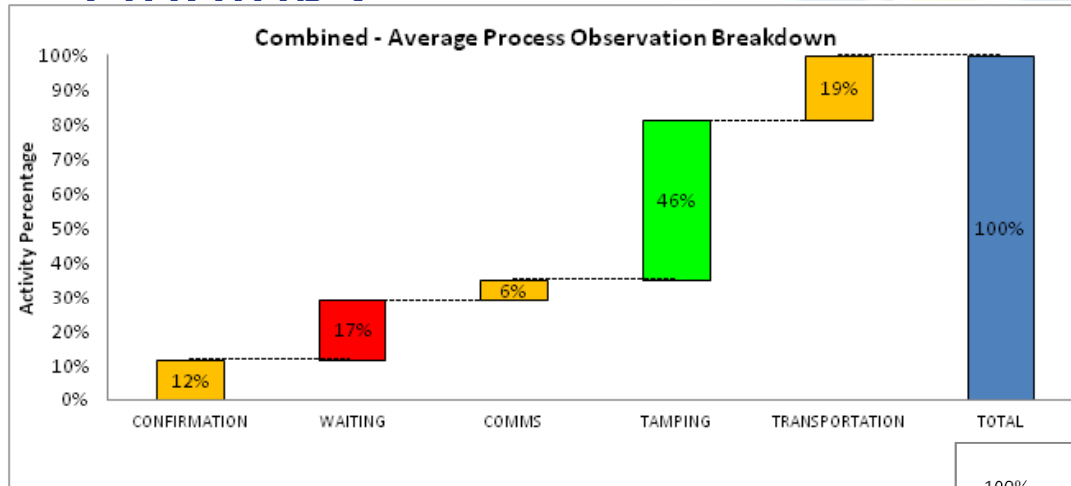
- Tamping Process: which perspective
 - One **tamping cycle** and its surroundings?



Process
Optimisation

Use of Lean Analysis in Automain

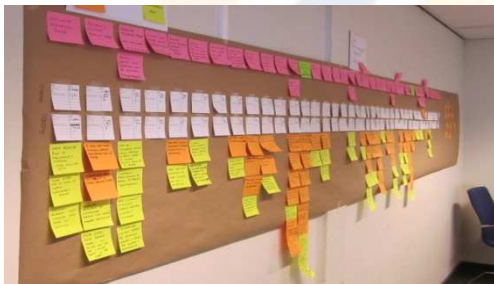
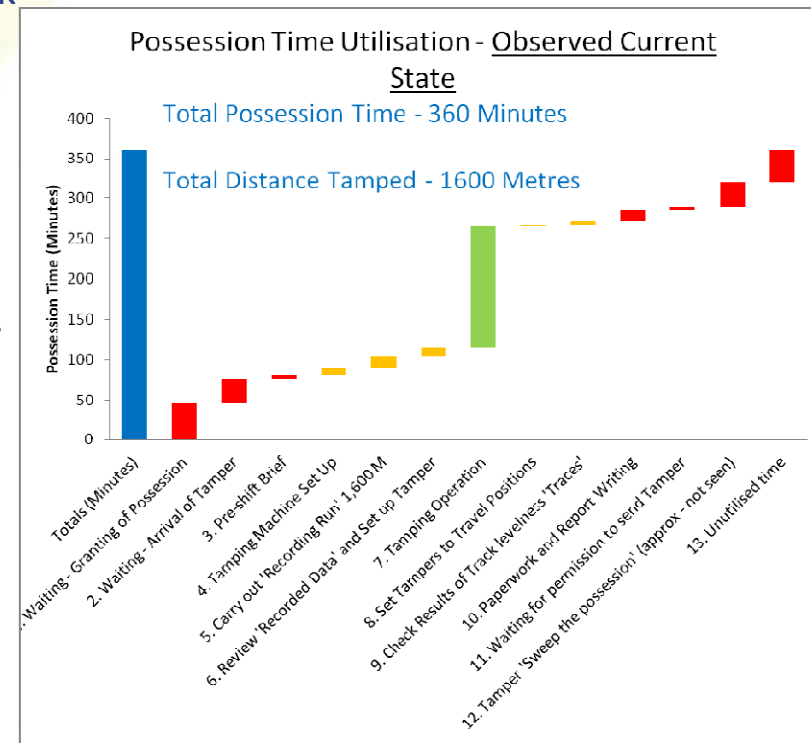
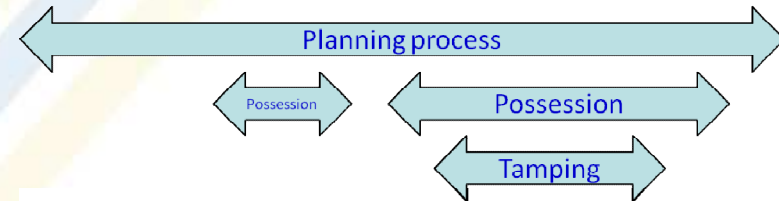
Findings:



Use of Lean Analysis in Automain

Findings:

- High levels of waiting
- Poor suitability of machine selected for the possession task
- Low Utilization of Available Possession Time.
- Potential to improve capacity and / or efficiency of Tamping Operation:
 - improved machine selection and
 - operator pace level up
- High variation in Safety Regulations and working practices.



Use of Lean Analysis in Automain

- Findings / suggestions, examples
 - A system showing the national maintenance resources (both manpower and equipment) would help mitigate the difficulty frequently encountered with aligning resources and maintenance requirements.
 - Certain administrations tamp only those areas deemed problematic, while others systematically tamp an entire length of line. An investigation of the various tamping approaches, potentially leading to the identification of which is the most effective approach, potentially leading to the identification of what is appropriate in what circumstances.

Possible?

- Hiring machinery is subject to free market

Is all about tamping strategy:
See presentation about
tamping

Conclusions

- Use Lean Analysis for specific scope
 - Within an organization
 - Specific work methods, e.g. welding
 - Hunt for waste within that specific work method
 - With respect to the unconditioned environment
- Use Lean Analysis within sector
 - With various partners involved
 - Create awareness amongst partners
 - for a certain subject, e.g. logistics around possessions