LEAN THINKING FOR CONSTRUCTION

Enabling Construction to Production

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Business Process Improvement leader
Transport for London

Bridge Owners' Forum - May 2015
Cambridge

Contents

- My background
- TfL's need for Continuous Improvement
- TfL's journey
- Three TfL examples
- Future relevance to the construction sector
- Obstacles to deployment
- No shortage of scope

My background

- Until 2004 – Royal Navy
- 2004 – Tubelines - track
- Metronet - Track
- PricewaterhouseCoopers
- Metronet Delivery & Engineering VP
- TfL Stations, Lifts and Escalators
- Northern Line Extension

TfL funding & Construction 2025

- **Move towards self funding**
- **Leverage internal capability**
- **Break silos**

"Unless we double productivity we won't have the supply chain to cope"

Revised TfL approach 1/2

- Build our internal BPI capability
- Deploy cross silos
- Grow internal knowledge and experience
- Empower staff to ask why and experiment
- Drive collaboration in TfL and with supply chain

Revised TfL approach 2/2

- Support and share best – community of practice
- Change our view from construction to production
- View all our systems as a process
- However to drive change we need a Paradigm shift – starting with delegation of control of CI to a group of peers

Guiding Council

Our course design (tbc!)

TRAINING DEVELOPMENT MATRIX

			DEPLOYED CAPABILITY							TRAINING CAPABILITY		EMPOWERMENT	
	COURSE	DURATION	CAPABILITY	LENGTH OF PROJECT THEY CAN BE DELPOYED ON	PROJECT GROUP SIZE	AMOUNT OF COACHING TIME NEEDED AFTER COURSE	DEPLOYED FULL OR PART TIME	BOUNDARY LIMIT TO THEIR DEPLOYMENT	TARGET AUDIENCE	COURSE INSTRUCTION	PROJECT COACHING	EMPOWERMENT ACHEIVED	LEVEL OF ADVOCACY
1	TFL LSS AWARE	30 MINS	BRIEFING THAT LSS IS COMING	N/A	N/A	N/A	N/A	N/A	TEAMS WHERE BPI YET TO BE DEPLOYED	NONE	NONE	ELIGHTENED	ACHIEVED
2	TFL LSS SPONSOR	1 DAY	SPONSOR, SUPPORT AND ENCOURAGE	N/A	N/A	10%	PART	THEIR IMMEDIATE AREA	SPONSOR OR LINE MANAGER OF BPI CAPABILITY/PROJECT	NONE	SUPPORT	SUPPORT & ELIGHTENMENT	SUPPORTS EXPERIMENT
3	TFL YELLOW BELT	2 DAYS	TEAM MEMBER OF RIW	16 HOURS	3	100%	PART	WITHIN OWN TEAM	TFL LSS AWARE	NONE	NONE	WORKING ON THEIR RIW IN THEIR AREA	EXCITED CONVERT
3A	ST YELLOW BELT ADD ON	1 DAY	TEAM MEMBER OF RIW	16 HOURS	3	100%	PART	WITHIN OWN TEAM	ST YELLOW BELT				
4	TFL ADVANCED YELLOW BELT	3 DAYS	LEADER OF RIP	16 HOURS	3	25%	PART	WITHIN OWN TEAM	TFL YELLOW BELT	ASSIST COURSE 1/2/3	ASSIST COACHING RIW	LEADING CHANGE IN THEIR AREAS	CONVINCING ADVOCATE
			TEAM MEMBER OF BIP	35 - 70 HOURS	3	50%	PART	WITHIN OWN DIRECORATE	TFL YELLOW BELT	ASSIST COURSE 1/2/3	ASSIST COACHING RIW	HELPING CHANGE IN OTHER AREAS	CONVINCING ADVOCATE
5	TFL GREEN BELT	5 DAYS	LEADER OF SIP	3-6 MONTHS	3 TO 10	10%	PART	WITHIN THEIR BUSINESS (ST OR R&U)	TFL ADVANCED YELLOW BELT	TEACH COURSE 1 ELEMENTS	LEAD BIP		ST/R&U INFLUENCER
6	TFL BLACK BELT	5 DAYS	LSS Black Belt	3-18 MONTHS	3 TO 30	Nil	FULL	ANYWHERE IN TFL	TFL GREEN BELT	TEACH ALL COURSES	COACH ALL PROJECTS		TFL INFLUENCER
7	TFL MASTER BLACK BELT	5 DAYS	LSS Master Black Belt	3-18 MONTHS	3 TO 30	NIL	FULL	ANYWHERE IN TFL	TFL BLACK BELT	TEACH BLACK BELTS	COACH BLACK BELTS		INDUSTRY LEADER

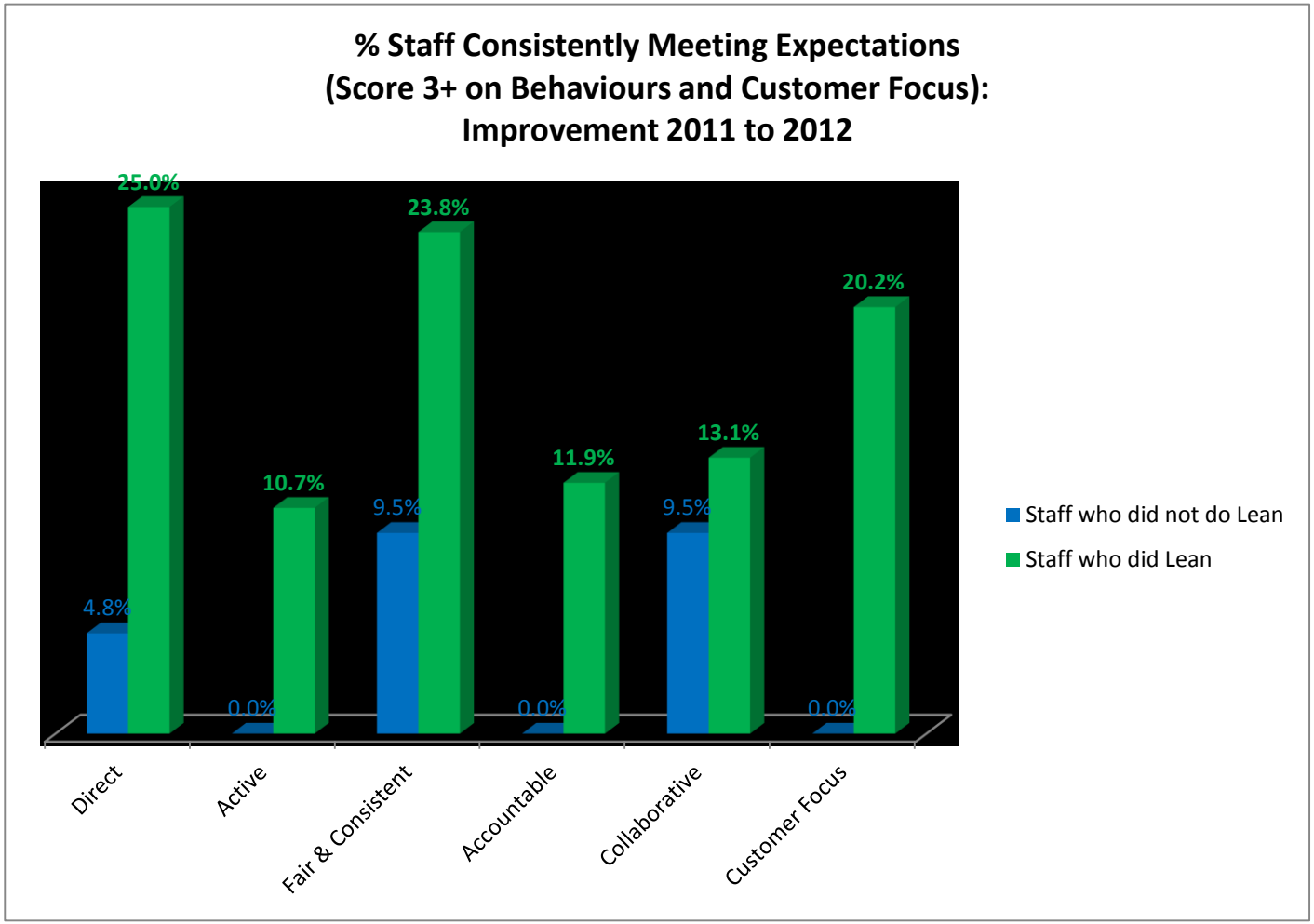
Why a paradigm shift?

- Change our learnt response to waste – Apollo 13
- Great fire fighters – but with time we focus on explain & guarantee, not improve
- Focus on ‘why’ without conflict, allowing safe experimentation
- Map the process, show the waste, make it a bit better
- Identifying waste becomes positive
- Denying or hiding waste becomes pointless

Go, Look, See and Steal (GLoSS)

- Horizon scanning - essential to learn from other innovators
- Shared experiments (successes and failures) will drive productivity
- Creates a community of practice outside just TfL
- Delivers a client who understands more, accepts their part in leading productivity improvement
- Changes TfL behaviours

Impact of Lean: Improvement 2011 to 2012



Case Study 1

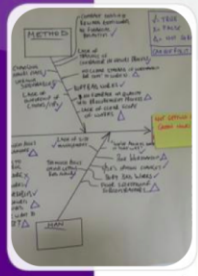
Notice Of Works Ready for Inspection

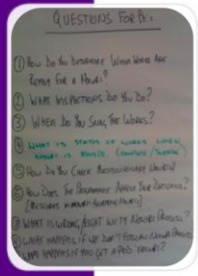
“your bathroom is finished now”

Lean Breakthrough Event Title:- Reducing waste within the inspection Process

From L – R

Richard Burton
Chris Barrett
Jag Chima





1. Background and reason for event

It was Senior management's original belief that we needed to focus on why the project teams were waiting too long for inspectors. The executive team originally put this down to a shortage of engineers.

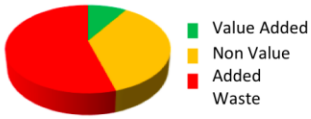
Our event focused on understanding the reasons why inspections were not passing first time and to find solutions to the root causes of those issues rather than throwing extra people at the problem.

2. Current state diagnostic

Analysis of the current NOWRI process showed us that there were :

22 Steps in total

- 2 are Value Added
- 8 are Non Value Added but Essential
- 12 are Waste



3. Current State Quantification

Key quotes about past NOWRI process:

"I'm waiting too long for inspectors"

"Engineering are blocking the project's progress"

"Engineering aren't interested!"

"Someone else will check this, I don't need to!"

"Nothing to do with me, this is engineering's problem!"

Total Process Cost Original (2010)

Engineering Hours: £3,300,000

Waste - £1,891,000

4. Goals, SMART targets

- To Increase the amount of 1st time green NOWRI's for 2011
- To gain buy in from all stakeholders to the revised NOWRI process and roll out modified process to the rest of the business, initially via the Asset stabilisation programme
- To move responsibility for inspections back to site team and contractors

5. Key waste areas / Root cause analysis

Key Wastes	Root Causes
• Too many inspections being carried out on small elements of work	• Overall plan at site not fully understood leading to scheduling issues with NOWRI checks
• Lack of ownership from the site team, relying on Discipline Engineer's and Lead Discipline Engineer's to snag	• No financial penalties on subcontractors for failed NOWRIs
• Checks not carried out properly by the site team	• No accountability or repercussions at site for lack of inspection at Project Engineer level
• Excessive Number of people attending NOWRI inspections who aren't adding any value	• "Someone else will check mentality"

6. Actions / solutions to root causes

	Root Cause	Action solution	When	Who
1	No responsibility at the site for quality of work	Increase seniority of attendees at each NOWRI revisit (up to VP level)	2/11	JC
2	NOWRI process not clear to all, many work arounds currently in place	Firm up NOWRI process through removal of amber status and stop reclassifications	12/10	RB
3	LDE's only involved at NOWRI stage of the project	Greater LDE support throughout the project and support from senior engineering team	11/10	RB

7. Process confirmation

Period confirmation of NOWRI status against plan during regular engineering review. Consultation with Graeme Shaw and other stakeholders to develop KPI's inline with Business needs

8. Did we achieve our targets

- Key Performance Indicator review began in February 2011
- Current trends show there is an improved proportion of successful NOWRI's
- Reduced number of cancelled inspections

9. Quantified results and Learning points

Improved Process Cost

In Eng Hours: £1,305,400

Elimination of Elemental NOWRI: £511,750

Saving from original process -
(Annual £1,817,150)
(£16,354,350 over 9 years)

Additional Benefits

- Engineers now have more time to engage in early life-cycle activities for generic solutions
- Earlier capture of construction issues which will reduce the level of on site re-work
- Behavioral changes are taking place as witnessed by the increase in number of snagging reports issued on time

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Case Study 2

NEC Contract Compliance - Asite

“you bite me, I bite you back”

The original perception

There was a feeling throughout the programme that we were not using the Contract Management System to correctly manage our Projects

Project Engineer

Reporting Analyst

Reporting Manager

What they found (April 2011)

49 Overdue PM responses to contractor NCEs

64 Overdue PM responses to quotations

536 Overdue submittal of quotations

649 late items

What they did

- ‘Go-look-see’ - A-Site team buy-in
- Mapped process for issues (not waste)
- Key stakeholders consulted
- Pre-conceived solutions parked
- Root causes identified not symptoms

Their simple actions and solutions

- New reporting process
- Comms Briefings
- Process confirmation
- Training – allowing people to admit they didn't know

Lean Breakthrough Event Title:- A-site compliance managing NEC contracts

From L – R
Kevin Walker
Jacqui Picot
Daniel Agutter

UNDERGROUND

1. Background and reason for event

The current perception within CPD is that Project Managers are not using A-Site correctly to manage NEC Contracts. This exposes CPD to major litigation risk from contractors in the future.

2. Current state diagnostic

Analysis of A-Site Statistics at 16/11/10:

- 81 overdue responses to contractor NCE's
- 91 overdue responses to quotations
- **Only 6% of contracts had accepted programmes**

3. Current State Quantification

The data found shows that we are not administering NEC contracts compliantly. Whilst the costs associated with this are highly subjective it is clear that the business is leaving itself exposed to a significant risk through:

- Uncertainty of final accounts, EFC confidence and risk/contingency release
- Poor claims defence and costs associated with discovery and arbitration
- Recovery of damages and impact on interfacing stakeholders

4. Goals, SMART targets

•We will understand the actual problem with NEC contract adherence and identify the root causes.

•We will then investigate improvement opportunities to reduce back log of A-Site responses and improve NEC contract adherence

5. Key waste areas / Root cause analysis

Root Causes

1. Lack of reporting visibility - PMs and SPMs currently do not receive A-Site status reports
2. Consolidated headline graphs reduce individual accountability
3. Sharp increase in overdue responses on A-site during absences
4. Lack of clarity regarding acceptable programme formats
5. E-mail prompt use is sporadic and inappropriate at times
6. Consequences of contract non compliance uncertain and in the future
7. Administration of NEC contract considered too burdensome for low value works
8. Lack of LU response to contractors NEC non-compliance undermining whole contract process

6. Actions / solutions to root causes

	Root Cause	Action solution	When	Who
1	Lack of NEC contract knowledge and training	Training sessions arranged and comms briefing planned	14/01/11	KW
2	Reporting process not aligned to business needs	Adjust report distribution and modify content	07/01/11	JP
3	Lack of focus within business monitoring devices such as PRM etc	A-site overdue responses to be reviewed at PRM's. New PPR form to include over due responses	07/01/11	DA

7. Process confirmation

- Monthly NEC contract and A-Site compliance on a project by project basis during the PRMs.
- Weekly visibility issue in the Vis Boards identified and taken forward by another LBE.
- SPM Reports distributed weekly.
- Training arranged for NEC and A-Site.

8. Did we achieve our targets

Post LBE:

- 40 % reduction in overdue responses to contractor NCE's
- 30% reduction in overdue responses to quotations
- Increased awareness, clarity and appropriate prioritisation reducing business risk.

9. Quantified results and Learning points

- Effective process confirmation within stations delivery programme to ensure alignment between senior managements objectives and PM's focus
- These improvements visualise CPD's clear and meaningful KPIs that will gauge NEC contract adherence throughout all projects
- Increase EFC certainty and improve risk/contingency release opportunities
- Standardisation of contract admin to enable future identification of waste within the actual process

This Lean Breakthrough Event is enabling a cultural change within CPD whereby none adherence to NEC contractual processes is no longer an accepted practise. This will mitigate the risk of a multi million pound legal dispute in the future

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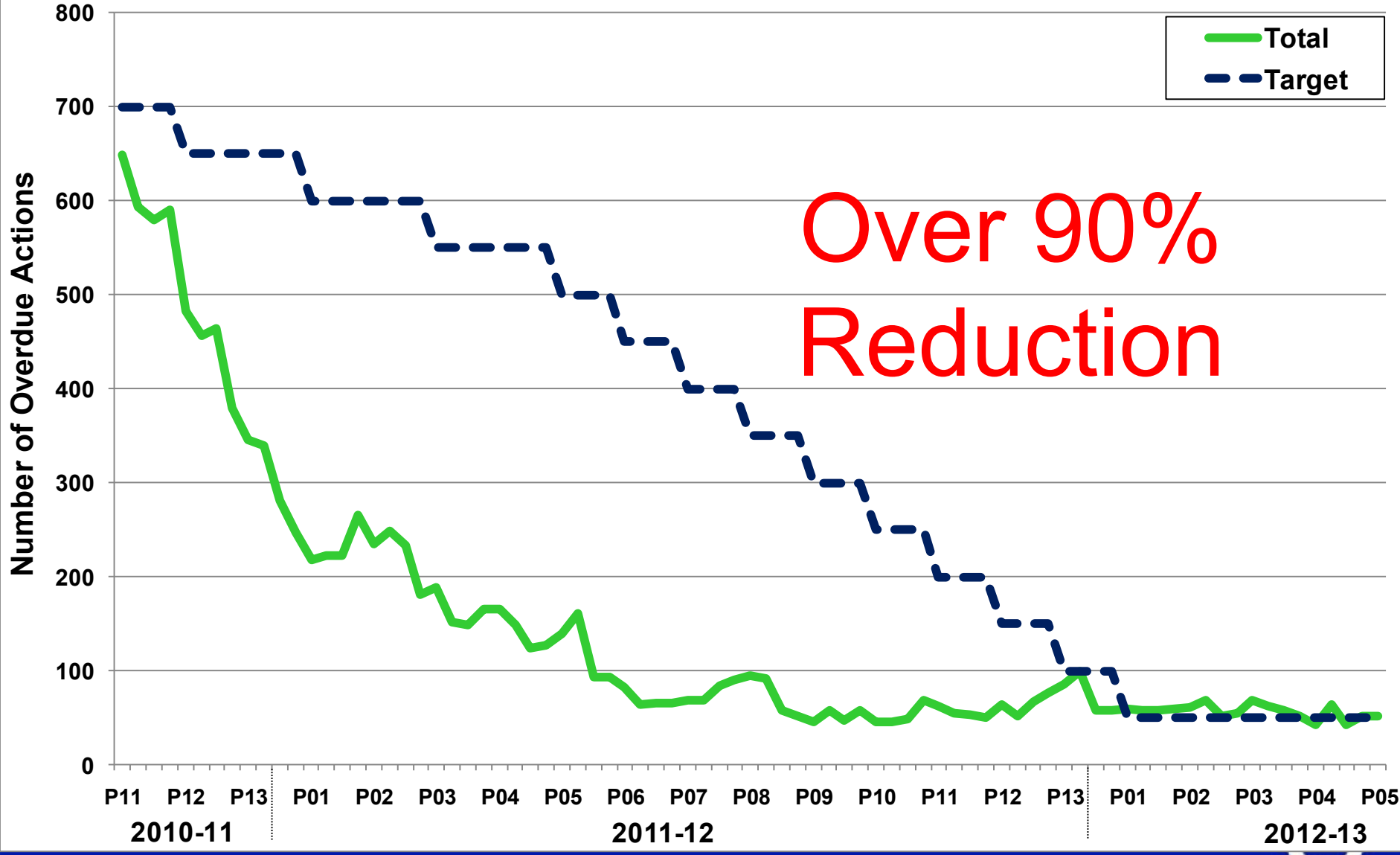
Overdue A-Site Actions



Their results

The output of this Lean Breakthrough Event was a mini ‘cultural change’ within our part of London Underground

Non-adherence to NEC contractual processes is no longer accepted practice

Case Study 3

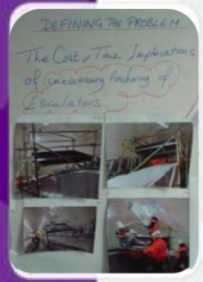
Escalator Anchoring

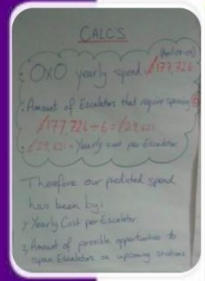
“make sure it doesn’t move”

Lean Breakthrough Event Title:- Escalator anchoring requirements

From L – R

Mike Row
William Mumford
Sheldon Kartreiber
Guy Barker
Martin Howard





1. Background and reason for event

The specific task that we are investigating is the anchoring of a escalator to enable scaffold erection between two escalators, or an escalator and a fix point other than the escalator. This is currently done to enable works above the escalators. The cost and time associated with these works is considerable, this team is investigating the reasons behind this process and whether it should continue.

2. Current state diagnostic

Our comprehensive investigation of the current condition shows the Maintainer is requested to anchor the escalator(s) when any work above the escalator is required. The team can find no standard or any evidence to support that this procedure is mandated and one of our major competitors, Tubelines, has already ceased this procedure through site based risk analysis. We can find is no evidence of an H&S reason for continuing this process.

3. Current State Quantification

Oxford Circus station Mods:

Cost = £1,064.22 / night
=> 167 times
=> **£177,726 / Year** ('08/09)

Cost due to time lost during Anchoring:

=> 30min on + 30min off
=> 1h / night for 3men gang @£50
=> £150 / night x 167 times
=> £25,050 /year

Our current state process map shows only 7% of the current 'Anchoring' process provides value for the project manager

4. Goals, SMART targets

Our target is to identify the reasons why anchoring is currently an accepted procedure within stations projects and to fully ensure that this activity is required and provides value for money for the tax payer

5. Key waste areas / Root cause analysis

Key areas of concern:

Throughout our LBE interviews and process analysis we have identified several reasons given for why the anchoring process is currently required:

"We have to do this to cover ourselves as brakes will fail due to lack of maintenance"

"We have always done it this way"

"The escalator cannot take the weight of the platforms on it's own"

The LBE team has not been able to find any direct evidence of these concerns actually happening during recent recorded memory

Root cause

This activity is seen as a "belt and braces" safety measure which provides a 3rd level of redundancy for escalator safety / braking systems. The additional cost has become the norm and hasn't been formally challenged for some time

6. Actions / solutions to root causes

	Root Cause	Action solution	When	Who
1	Brakes will be poorly maintained and not effective	Site based risk assessment will be completed	16/01/12	MH
2	This is the "traditional" accepted way of doing things	Full communications package detailing reason for not anchoring	03/02/12	SK
3	Perception that escalators won't support weight of platforms without anchoring	Sharing of current standards detailing the optional nature of anchoring	03/02/12	GB

7. Process confirmation

This process will be confirmed by the following:

1. Monthly meeting with 'Heads of department' to understand the take up of the new process
2. Monthly meeting (during night shift hours) with CSM's to gather usage data regarding escalator anchoring
3. Inclusion of LBE findings into the next quarterly newsletter

8. Did we achieve our targets

Success for this LBE team will be reducing the number of escalator anchoring for spanning works by 90% by the start of the new financial year (Apr '12). This will ensure the team realise the significant time and cost savings identified

9. Quantified results and Learning points

Quantified findings:

We have calculated savings on the next 11 (of the 71) refurbishment stations.

Based on values calculated for Oxford Circus
£1064.22/night, in 167 occasions =
£178k/year (Apr 08 – Apr 09)

The lack of anchoring will save £859,000 with an additional £111,000 of labour completed during the time saved

£970,000 per year

Learning points:

"Learning how to change processes has been a challenge. But with teamwork we will change attitudes"

"With clear process mapping and visualising problems we can voice our opinions"

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Date:

09 December 2011

Relevance to construction sector C2025

- C2025 daunting targets:
  - 33% lower cost than today
  - 50% faster from inception to completion
- Improve client capability (we must drive this!)
- People to be talented and diverse
- Change the public's view of construction

Blockers – Investment or belief

- Need to invest to create capability
- Need to believe before you invest
- Need to be prepared to speculate to accumulate
- Data on savings is fantastic (30:1)
- Data on behavioral change (sustainment) is thin
- Need academic research to assist, guide and enlighten – prophet in another land


PRINCIPLES & PURPOSE
PRINCIPLES & PURPOSE
Towards a leaner Tube
F
Over the last two years, a department of London Underground (LU) has delivered over £10m of repeatable savings and liberated over 50,000 working hours. Graeme Shaw, Head of Station Upgrades, describes the reasons for choosing lean and the design of the Lean Transformation Programme.
11


Special Report: Civils
Tube chiefs make savings thanks to lean management
EFFICIENCY
KATIE BARKER
£13m
Value of savings identified so far by LU's training scheme
"We tend to find that between 90 to 97 per cent of what we do in these processes can be described as waste"

Evidence of success - HA

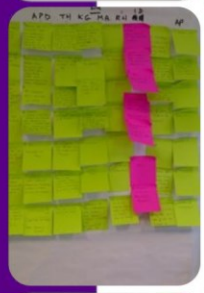
Type	Name	Purpose	Planned Benefits	Realised Benefits
Project	NetServ Lean Finance - Phase 2	To improve NetServ expenditure accuracy annually and monthly.	£0 planned saving 3572 hours planned saving	£0 realised saving 3572 hours saved
Project	Major Projects Property Acquisitions	To reduce the average time taken between “Notice To Enter” and legal completion of a purchase. To ensure that resources spent on the acquisition process are done so efficiently and effectively. To ensure that process requirements (PLC) on staff are proportionate and appropriate		
Project	Official Correspondence Process	To improve the customer experience in both time and quality when receiving a CEO response. To improve the efficiency of the process in consultation with the people involved in the delivery to ensure they feel they add value.	1 hours planned saving	7696 hours saved
Project	Health and Safety Process	Improve the quality and effectiveness of H&S incident reporting, investigation and action planning in accordance to the HA Board targets	£1000 planned saving 985 hours planned saving	£1000 realised saving 985 hours saved
Project	NDD Approvals Project			
Project	APTR Roadworks Notification to Control Rooms	To increase the performance of the setting of signs and signals during peak periods for planned works (usually Mon to Fri 20:00 to 22:30). The no. of planned works is typically 40 to 80 each weekday. The average job time is 19.4 mins.	£20000 planned saving 300 hours planned saving	£16800 realised saving 490 hours saved
Project	TMD Hot Debrief Process	Define and implement a standardised debrief process across all regions and teams; maximise the number of lessons learnt at each debrief stage; ensure appropriate lessons are transferred	3343 hours planned saving	

Evidence of success - TfL

Project Title	Project Description	Project I	Status
Design Lean Review - Carriageways	Reduce leadtime		Live
Develop performance metrics in Capital Renewals	Develop performance metrics to monitor delivery through key steps, including format, structure, governance		Not started
Develop process for issuing packages of work to contractors	Develop process for issuing packages of work to contractors		Not started
Create process for quarterly planning	Create process (inc. RACI, Inputs/outputs, info flow, etc) for quarterly planning with 12 - 16 month horizon		Not started
Implement Workplace organisation (5S, visual mgt, etc)	Implement Workplace organisation (5S, visual mgt, etc)		Not started
SEPM Data Reliability			Live
Countdown Sign Restoration			Live
Increase successful prosecutions			Live
Reduction in admin days			Live
Increase compliance inspections			Live
Reduction in admin days			Live
Understanding Load and Capacity			Live
Stage 1 Process Review			Live
Create Pre-stage 1 Process			Live
Specification/Brief document standard			Live
Internal Governance Review			Live
Characterise/Understand Rework Loops			Live
Performance metrics Kaizen			Not started
Feasibility Design Lean Review			Live
LSTOC Tunnel Closures			Live
Minor Approvals Process			Live
MIRP Industrial Action			Live
RNC Camera Deployment			Live
Defect Reduction			Live
Signals Scheme Alignment Phase 2			Live
Lean Process			Live
TI BAU Schemes			Live
Licensing Overtime			Live
VCS Night-time staffing			Live
Camera Kaizen			Not started
Data Kaizen			Not started
Visual Management Kaizen			Not started
Capacity Kaizen			Not started
Visual Management Kaizen			Not started
Resource Moddeling Kaizen			Not started
Visual Management Kaizen			Not started
Performance Metrics Kaizen			Not started
5S Rollout			Not started
Design Lean Review - Tunnels and Structures	Reduce leadtime		Not started

Lean Breakthrough Event Title:- Excessive snags / defects at 48 hour cut off.

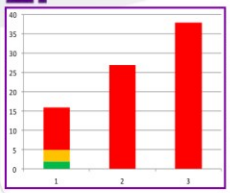
From L-R
Terry Collinson
Minnie Ruggiero
Kevin Jordan
Ramzi Soussou
Mike Toole
Suresh Thiagarajan



1. Background and reason for event

Prior to this Lean Breakthrough Event there was a perception within the team that there are an excessive number of snags / defects at the 48hr cut off period for NOWRIs. The team highlight that defective works appeared to be caused by poor controls and lack of information on site.

2. Current state diagnostic



Having mapped the existing ITP and NOWRI stage, the team visualised their findings. There are two main areas of waste, the ITP review process and the NOWRI process if snags are found and require to be reworked.
ITP Review: There are a minimum of 5 Steps up to Gate Four if the document is successful first time and if unsuccessful the steps increase to a total of 16. These were broken down as follows: **2 VA & 3 NVA** processing steps. Each review loop adds **11 waste** steps. The customer is the Project Engineer (PE). Targeting the reason for ITP failure & rework will reduce the waste in both the ITP review and the NOWRI stage.

3. Current State Quantification

The team identified the following:
On the basis that reworks happen once.
Number of Steps in the Process if all accepted first time = 9 but if rejected that process increases to 28.
LU staff hours if the process passes first time is 45 at an estimated cost of £2210
LU staff hours if all fail x 1 = 145 (plus an average 2 week delay to programme at £4000 a day) at an estimated cost of £47170
Each failure time increases the process by 100 man hours
PE /CM rate = £50/per hour DC = £30 per hour
Therefore the cost of rejections increase x 21 in the first stage.

4. Goals, SMART targets

The team will address the following issues:

1. Snags at NOWRI.
2. Waste from ITP Process.
3. Waste at NOWRI Stage.
4. Communications between parties..

5. Key waste areas / Root cause analysis

Key Problem Areas

1. Quality of Works is a key problem area which is affected by poor storage, faulty materials, Incorrect materials used, poor ITP Checklist, and not working to Programme.

2. ITP/Checklist Approval (issues) result in poor design, lack of understanding, review process, and the ITP Procedure Accountability for sign off.

Root Causes

1. Lack of Site Supervision.
2. Improvement of Contractor Site Management.
3. Implement Staff Competency.

6. Actions / solutions to root causes

	Root Cause	Action solution	When	Who
1	Lack of Site Supervision.	•Ensure structured inspections. •Develop ITP Checklists to reflect LU requirements. • Upgrade report-formats.	1st April - 31st May 2012	RS
2	Improvement of Contractor-Site Management.	•Good systems-competent PM/CM •Thorough supervision. •Site Management Plan /experienced PM/CM.	1st April-31st May 2012	KJ
3	Implement Staff Competency.	•Check qualifications & Experience (CV- •Check) •Support & Guidance.	1st April-31st May 2012	TC

7. Process confirmation

• Anne Potter to include an item to the Engineering Forum Agenda (Monthly) for the PE to report back on the use of the new ITP Checklist on progress /quality of works.
• A trial project will be identified to see how successful the new format will be.
• The contractor will be requested to give feedback on how the new ITP Checklist is performing via a questionnaire issued by PE

8. Did we achieve our targets

Once we have implemented the changes we will monitor the amount of snags that are occurring at the " NOWRI " request stage.

We will monitor 3 specific projects to illustrate this on a weekly basis.

9. Quantified results and Learning points

Currently we have 25% of NOWRIS that have snags and failed and not successful 1st time. (12 out of 47) from period

Cost to Business approx for 2.5 months: = £59,000

Saved = £295,000 per annum.

(Based on 60 failures per annum)

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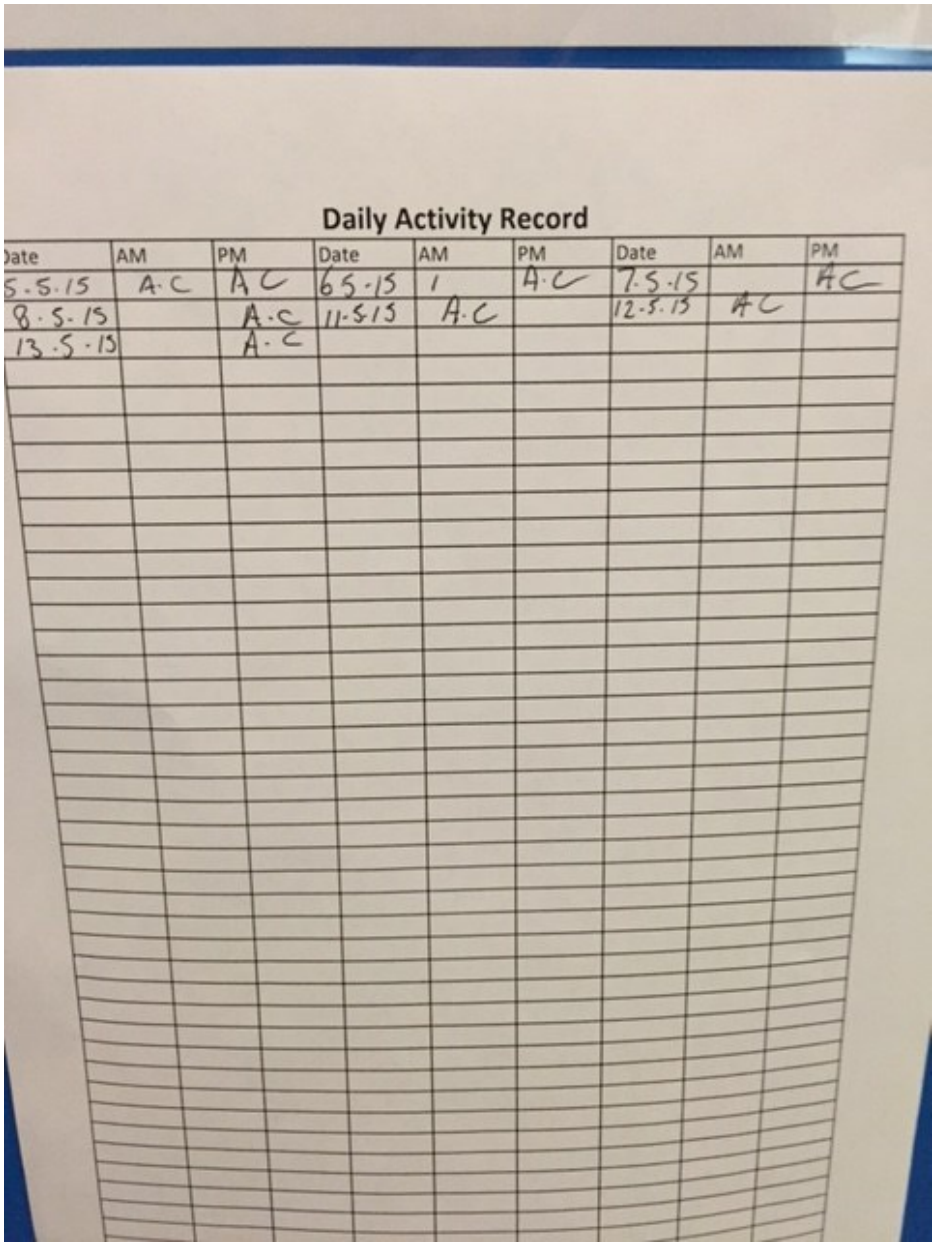
Date:
29/03/2012



Daily Activity Record

Date	AM	PM	Date	AM	PM	Date	AM	PM
5.5.15	A.C	A.C	6.5.15	I	A.C	7.5.15		A.C
8.5.15		A.C	11.5.15	A.C		12.5.15	A.C	
13.5.15		A.C						

Questions

Graeme Shaw

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