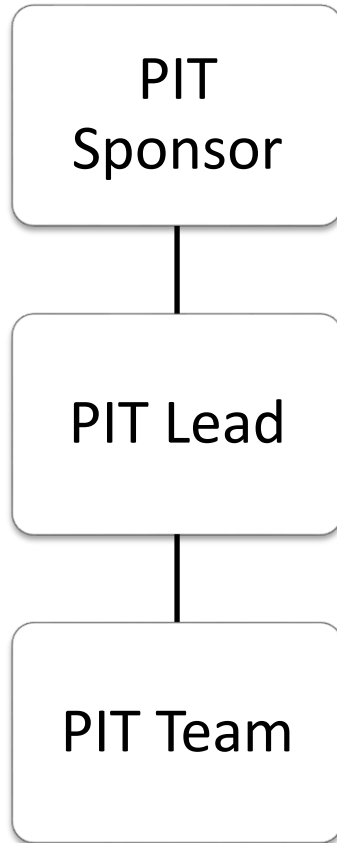


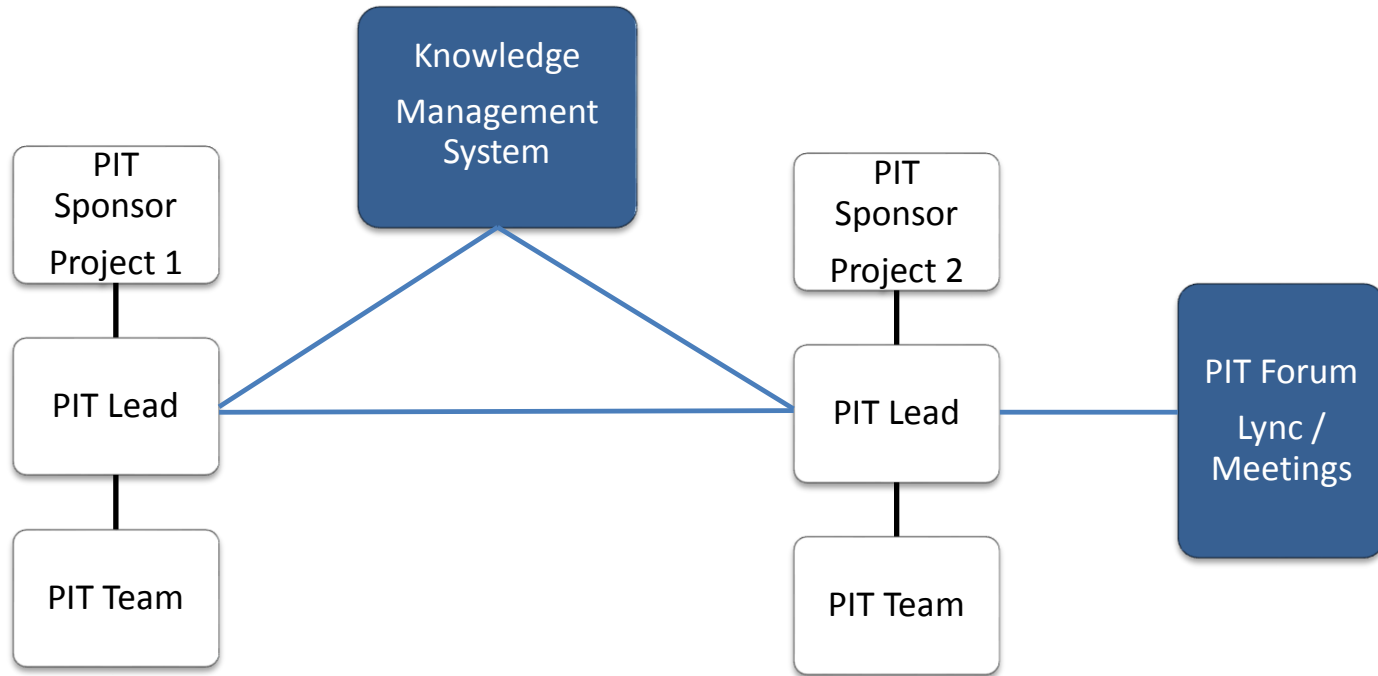
Skanska's approach to the development of a sustainable Lean community

Paul Henry (Skanska)
Andrew Moore (Rubicon Wigzell)

FLITe & PIT



The PIT Network & Support



Connected people with peer and system support.

Organic migration of best practice and improvement culture.

The Plan

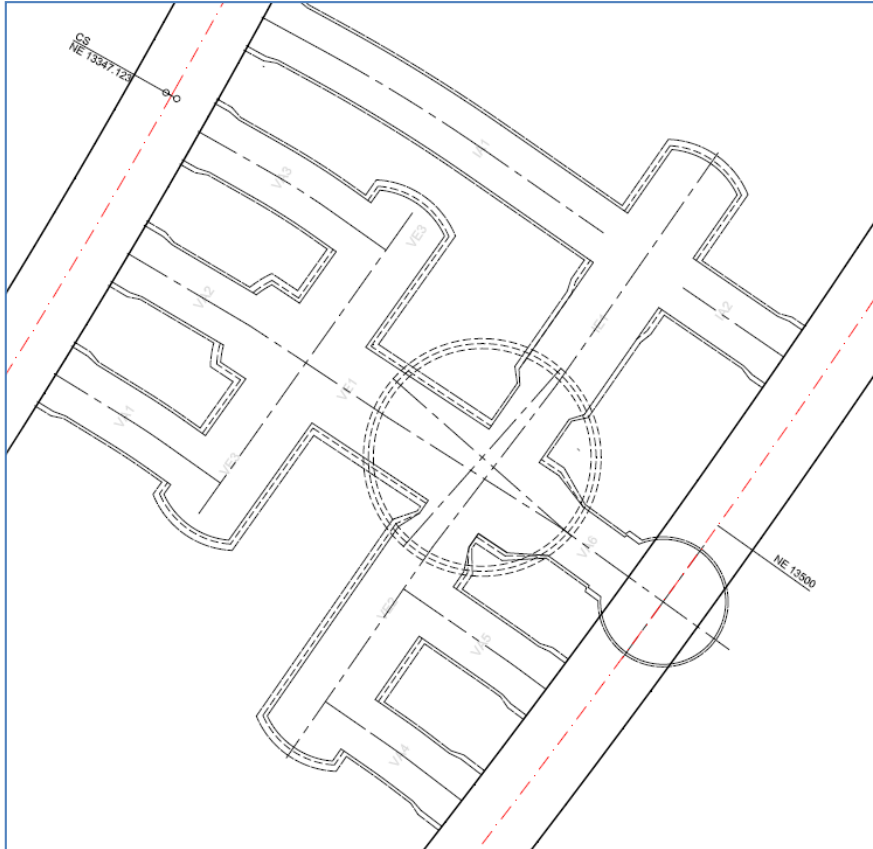
- FLITe Programme delivered to circa 200 front line Skanska staff inc Engineers and Agents
- This currently includes a mix of staff from 10% client and 15% supplier organisations
- 92 people have gone through the programme so far (+ sponsors and supervisors) and delivered savings of = £5.2 Million



Paul Henry FLite Programme Improvement Project – C360 Eleanor Street and Mile End Project



Eleanor Street Adits:



How can we go faster?

My Improvement Project:

Improvement Project Objective: Opportunity to improve efficiency of SCL works

1. Set up data collection device.
2. Establish weekly workplan that ties in with 4 week look ahead.
3. Conduct observations + collect data on spraying and excavating.
4. Assess output against agreed collaborative planning dates.
5. Identify opportunity to increase or improve and decrease downtime.
6. Implement with supervisors and operatives.
1. Verify Improvement

FLITE Programme Improvement Plan

SKANSKA

Candidate Name: Paul Henry	Focus Area: Sprayed Concrete Lining
Company Under Review: Skanska/JGL	Date Plan Produced: 24/1/14

Improvement Project Objective:		
Opportunity to improve efficiency of SCL works		
Activity	Who	When
Set up data collection device	PH	1.2.14
Establish weekly workplan that ties in with 4 week look ahead	PH	1.2.14
Conduct observations + collect data on spraying and excavating	PH + Site Engineers	14.2.14
Assess output against agreed collaborative planning dates	PH	7.2.14
Identify opportunity for increase or improve and decrease downtime	JGL manager and Tunnels manager	28.2.14
Implement with supervisors and operatives	JGL manager and Tunnels manager	
Write case study	JGL manager and Tunnels manager	

Lean Improvement Techniques

1. Improvement Thinking Forum
2. Data Capture
3. Collaborative Planning
4. One Week Lookahead
5. Visual Management

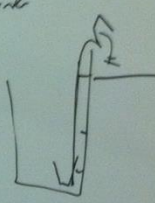


Lean Improvement Techniques

Improvement Thinking Forum

THINGS WE CAN DO ANALYSIS CSD SEL CYCLE TO IMPROVE CYCLE TIMES ANALYSIS

PROCESS	PLANT	PEOPLE	ACTION
1. COMBINE INVERT & BENCH (M)	1. CHANGE INVERTALIS	1. BONUS	1. CHERRY PICKER (SUITABLE)
2. CUT THE BENCH TO EASE ACCESS FOR ORUGA (RESS)	2. SPEED UP SIGA OUTPUT	2. LADDER BAY ACCORD	2. WHEN DOES THIS SCHOOL BREAK UP
3. GET RID OF KWIKASTRIP (M)	3. BIGGER EXCAVATOR FOR INVERT	3. BIGGER MAN RIDER	3. BIGGER MAN RIDER
4. REMOVE EXCAVATED GULL WITHOUT SPRAYING	4. BIGGER SPRAYING UNIT FOR P2	4. 3-4 FLOOR SITE (M)	4. TRAINING FOR INSPECTORS ON EARLY AGE/SEL TESTING
5. FAST PROCEDURE MAX NUMBER OF PEOPLE	5. CIRCULATING PUMP TO PREVENT FREEZING	5. HOT SEAT CHANGE AT PALE	
6. 24/7 WORKING	6. T-PIECE AT PLANT TO REMOVE OLD WATER	6. SURVEY TIMES	
7. PAVING WORKING WEEKEND	7. CHERRY PICKER (TRACKED)	7. MONITORING OF WORKS BY INSPECTORS	
8. RECESS IN PIT BOTTOM FOR MUCKING	8. INTRODUCE LOADING SHOUL	8. RADIO CHANNEL FOR ENGINEERS	
9. PLANTING	9. SECOND PUMP & RETRIEVER FOR WET MIX (LOGISTICS)	9. INSPECTORS	
10. ARRIVAL OF WESTBOND FISH	10. STORAGE CAPACITY OF SEL IN PIT BOTTOM	10. ROUNTON ROAD COMPLETE SITE FACILITIES TO ALSO MANAGE PRESENCE ON (M) SITE	
11. GARAGES USING ADIT EYES (M)	11. HYDRAULIC HOSE FIT OUT CONTAINER	11. INSPECTORS USED TO PERFORM EARLY AGE STRENGTH/JUMP TEST	
12. SLICK CHANGEOVER	12. HOLDING AREA FOR JAGONS ROUTE PLANNING	12. EXTRA TOILETS	
	13. WEIGHT OF MUCK WAGON LAIDBACK		
	14. REPLACEMENT ROUTE (M) PLAN		
	15. EXTRA TOTAL STATION		



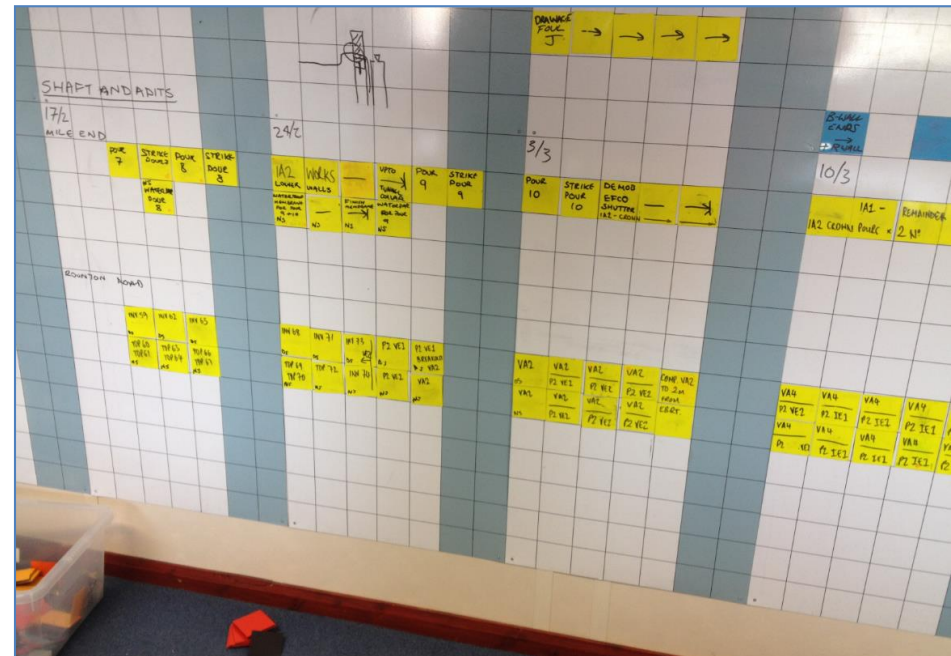
Lean Improvement Techniques

Data Capture

SCL Timings																			
Tunnel	Chainage		Advance (no. off RESS)	TH/BI	Excavation		Theoretical Volume m3/hr	Sealing			Volume Theory Sprayed (m3)	Volume Actual (m3)	Spraying		Time Taken (hrs)	Volume Theory Sprayed (m3)	Volume Actual (m3)	Wastage (m3)	
	from	to			Start	Finish		Start	Finish	Time Taken (hrs)			Start	Finish					Time Taken (hrs)
E1	4.2	5.2	1		12/12/2013 18:15	13/12/2013 12:30	18:15		13/12/2013 08:50	13/12/2013 09:10	00:20	3	13/12/2013 13:00	13/12/2013 14:35	01:35				
E1	4.2	5.2	2	I	13/12/2013 16:30	14/12/2013 01:30	09:00		Sealed & Sprayed to full profile in one session				14/12/2013 02:00	14/12/2013 03:30	01:30				
E1	5.2	6.2	3	TH	16/12/2013 07:30	16/12/2013 12:15	04:45		16/12/2013 12:30	16/12/2013 13:00	00:30	3.2	16/12/2013 13:45	16/12/2013 14:30	00:45		9.3		
E1	6.2	7.2	4	TH	16/12/2013 19:20	16/12/2013 22:40	03:20		16/12/2013 21:20	16/12/2013 22:40	01:20		16/12/2013 23:10	17/12/2013 00:10	01:00				
E1	5.2	6.2	5	I	17/12/2013 00:30	17/12/2013 01:40	01:10		Sealed & Sprayed to full profile in one session				17/12/2013 01:55	17/12/2013 02:20	00:25				
E1	7.2	8.2	6	TH	17/12/2013 03:00	17/12/2013 21:30	18:30		17/12/2013 17:45	17/12/2013 18:30	00:45		17/12/2013 22:10	17/12/2013 23:53	01:43				
E1	6.2	7.2	6a	I	18/12/2013 19:25	18/12/2013 23:00	03:35		Sealed & Sprayed to full profile in one session				18/12/2013 23:30	19/12/2013 00:05	00:35				
E1	8.2	9.2	7	TH	18/12/2013 01:40	18/12/2013 06:30	04:50		18/12/2013 06:40	check diary			18/12/2013 16:10	18/12/2013 17:20	01:10		13		
E1			8		01/01/2013 00:00	01/01/2013 00:00	00:00		01/01/2013 00:00	01/01/2013 00:00	00:00		01/01/2013 00:00	01/01/2013 00:00	00:00				
E1	9.2	10.2	9	TH	19/12/2013 00:40	19/12/2013 06:40	06:00		19/12/2013 03:25	19/12/2013 04:00	00:35		19/12/2013 07:30	19/12/2013 09:00	01:30		9.1		
E1	7.2	9.2	10a	I	20/12/2013 00:15	20/12/2013 05:30	05:15		Sealed & Sprayed to full profile in one session				20/12/2013 05:30	20/12/2013 06:30	01:00		7		
E1	8.2	9.2	10b	I	07/01/2014 13:00	07/01/2014 20:40	07:40		07/01/2014 17:45	07/01/2014 18:10	00:25		07/01/2014 21:10	07/01/2014 22:55	01:45				
E1	10.2	11.2	11		19/12/2013 11:10	19/12/2013 15:00	03:50		Sealed & Sprayed to full profile in one session				19/12/2013 16:30	20/12/2013 00:15	07:45		14.3		
E1	11.2	12.2	12	TH	06/01/2014 18:30	07/01/2014 05:20	10:50		07/01/2014 02:40	07/01/2014 06:50	04:10		07/01/2014 07:55	07/01/2014 09:55	02:00				
E1	12.2	13.2	13	TH	07/01/2014 02:00	07/01/2014 08:30	06:30		17:45	18:10	00:25	6	08/01/2014 11:10	08/01/2014 12:15	01:05		12.5		
E1	9.2	11.2	14	I	08/01/2014 13:20	08/01/2014 17:45	04:25		08/01/2014 16:50	08/01/2014 17:05	00:15	-	08/01/2014 19:00	09/01/2014 00:50	05:50		-		
E1	13.2	14.2	15	TH	09/01/2014 01:40	09/01/2014 04:30	02:50		09/01/2014 04:50	09/01/2014 09:00	04:10		09/01/2014 09:15	09/01/2014 10:28	01:13		8.9		
E1	14.2	15.2	16	TH	09/01/2014 11:30	09/01/2014 13:00	01:30		09/01/2014 13:00	09/01/2014 13:15	00:15	3	09/01/2014 14:50	09/01/2014 17:50	03:00		9.8		
E1	11.2	13.2	17		09/01/2014 17:10	10/01/2014 00:30	07:20		Sealed & Sprayed to full profile in one session				10/01/2014 01:10	10/01/2014 03:15	02:05		15		
E1	15.2	16.2	18	TH	10/01/2014 04:20	10/01/2014 09:30	05:10		10/01/2014 06:30	10/01/2014 10:40	04:10	6	10/01/2014 11:30	10/01/2014 13:15	01:45		8.7		
E1	16.2	17.2	19	TH	10/01/2014 13:40	10/01/2014 17:20	03:40		10/01/2014 15:15	10/01/2014 17:35	02:20	-	10/01/2014 18:00	10/01/2014 20:30	02:30		11		
E1	13.2	15.2	20	I	10/01/2014 21:15	10/01/2014 04:15	07:00		11/01/2014 02:00	11/01/2014 02:20	00:20		11/01/2014 04:45	11/01/2014 06:20	01:35		20.8		
E1	17.2	18.2	21	TH	13/01/2014 08:45	13/01/2014 10:15	01:30		13/01/2014 10:40	13/01/2014 13:30	02:50	6	13/01/2014 13:30	13/01/2014 14:35	01:05		15		

Lean Improvement Techniques

Collaborative Planning



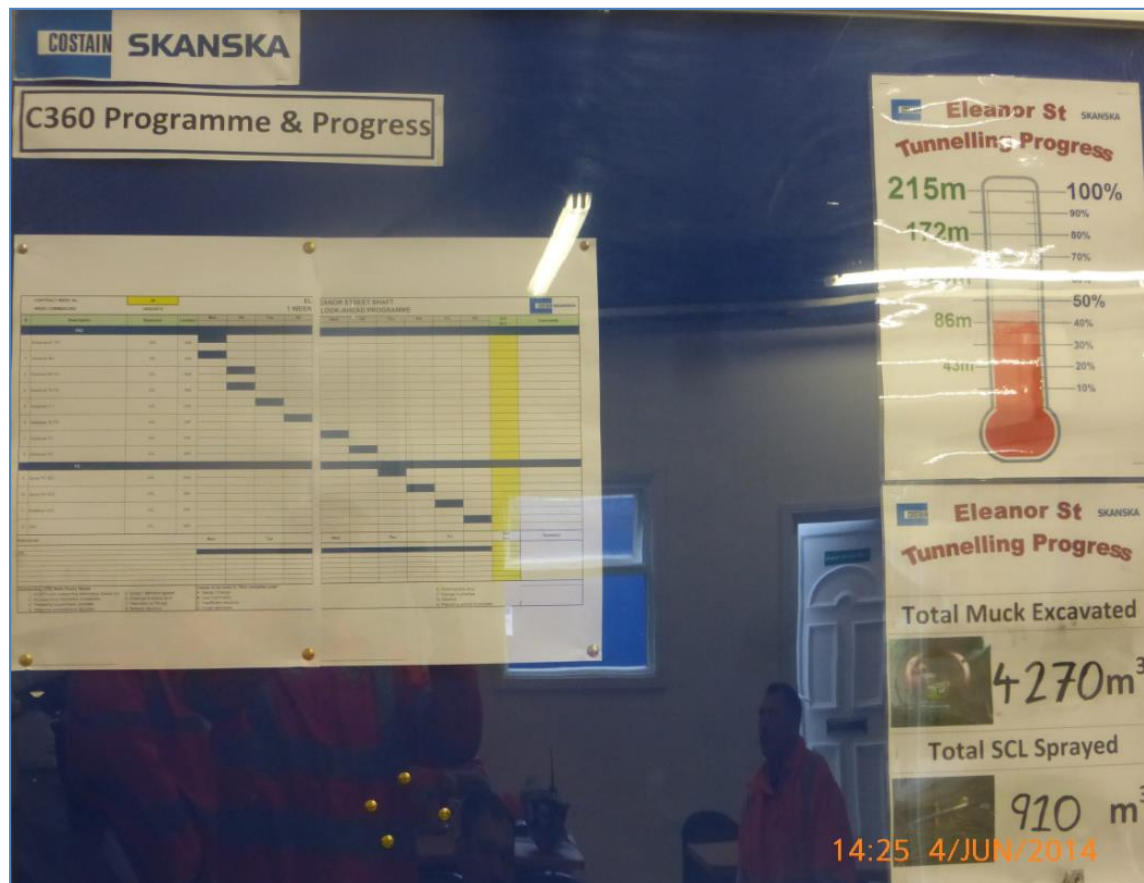
Lean Improvement Techniques

One Week Lookahead

CONTRACT WEEK No.				87		ELEANOR STREET SHAFT														COSTAIN SKANSKA			
WEEK COMMENCING				03/02/2014		1 WEEK LOOK-AHEAD PROGRAMME																	
#	Description	Resource	Location	Critical	Mon	NS	Tue	NS	Wed	NS	Thu	NS	Fri	NS	Sat/Sun	O/S Make Ready Needs	Percentage complete	Non complete code	Comments				
IE1																							
1	Adv 40a and b	JGL	Adit	Y																			
2	Invert 42	JGL	Adit	Y																			
VE2																							
3	Breakout VE2 Adv 1	JGL	Adit	Y																			
4	Breakout VE2 Adv 2	JGL	Adit	Y																			
5	Adv 3 Transition Top Heading	JGL	Adit	Y																			
6	Adv 4 Top Heading	JGL	Adit	Y																			
7	Adv 5 Top Heading	JGL	Adit	Y																			
Resources					Mon		Tue		Wed		Thu		Fri		Sat/Sun				Summary				
JGL																			7	Number of Operations			
																			7	Number Achieved			
																				Number Not Achieved			
																				Percentage Achieved			
Outstanding (O/S) Make Ready Needs					Values to be used in "Non complete code"										Notes								
1. All RFI's and outstanding information closed					A: Design Change										E: Workmanship error								
2. All supporting information is available					B: Late Information										F: Change in priorities								
3. Preceding support task complete					C: Insufficient resource										G: Weather								
4. Resource available and allocated					D: Under estimated										H: Preceding activity incomplete								
5. Scope / definition agreed																							
6. Drawings & specs rec'd																							
7. Instruction or PM acc																							
8. Material, Machine																							

Lean Improvement Techniques

Visual Management



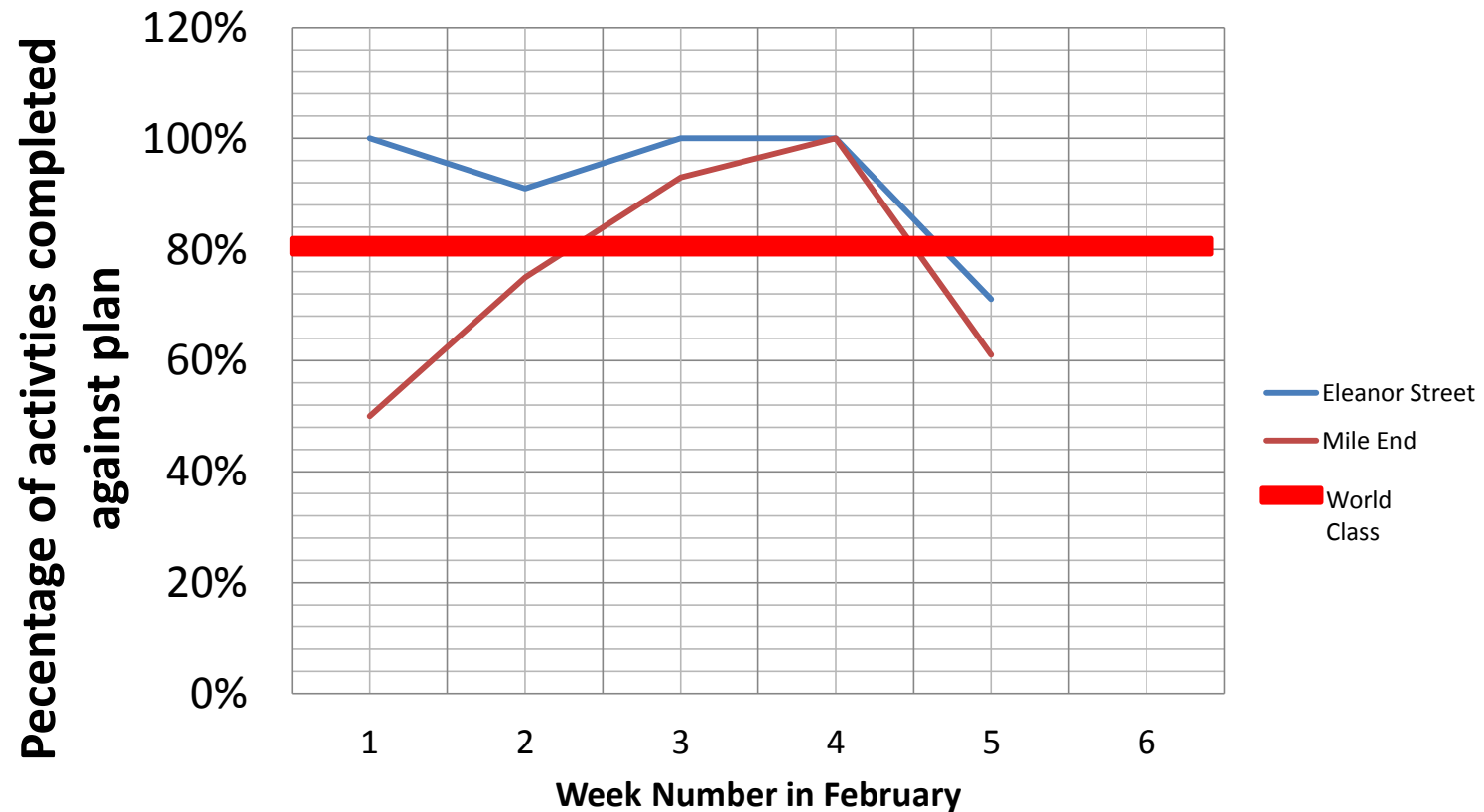
Eleanor Street Prog Achievements:



Week	Percentage Planned Complete	Root Cause
1	100%	
10.2.14	91%	
17.2.14	100%	
24.2.14	100%	
3.3.14	71%	Safety Stand down

Summary

February PPC Assessment

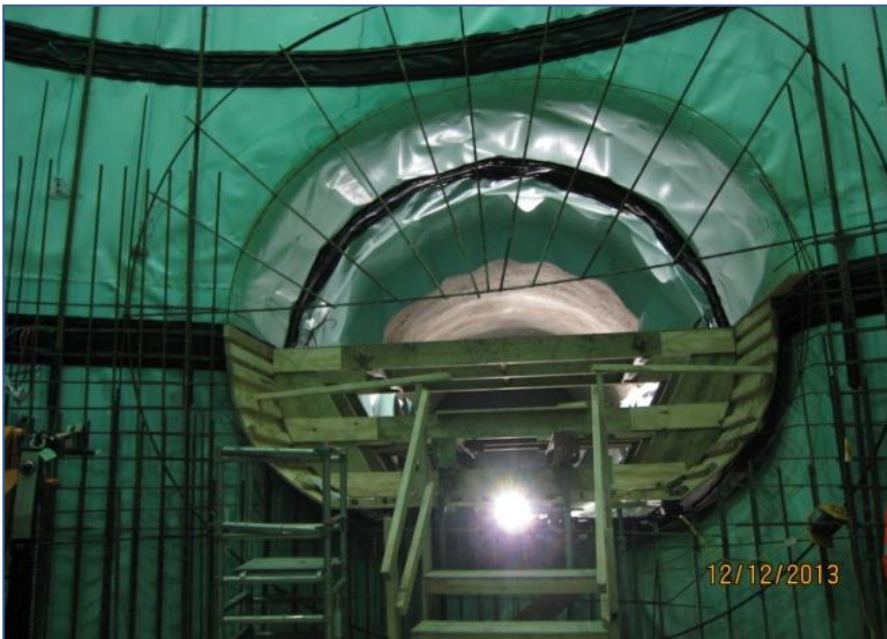


Summary - Key Achievements

1. 1 hour a day standing time saved due to the introduction of a new total station for monitoring.
2. Accurate records to the hour of site activities have been used for accurate Programme measurement and to support compensation events.
3. SCL analysis and records for future use on tenders.



Week	Percentage Planned Complete	Root Cause
3.2.14	50%	Weather / Waterproofing s/c resource
10.2.14	75%	Weather
17.2.14	93%	
24.2.14	100%	
3.3.14	61%	Adjustment in work priorities/Stand down

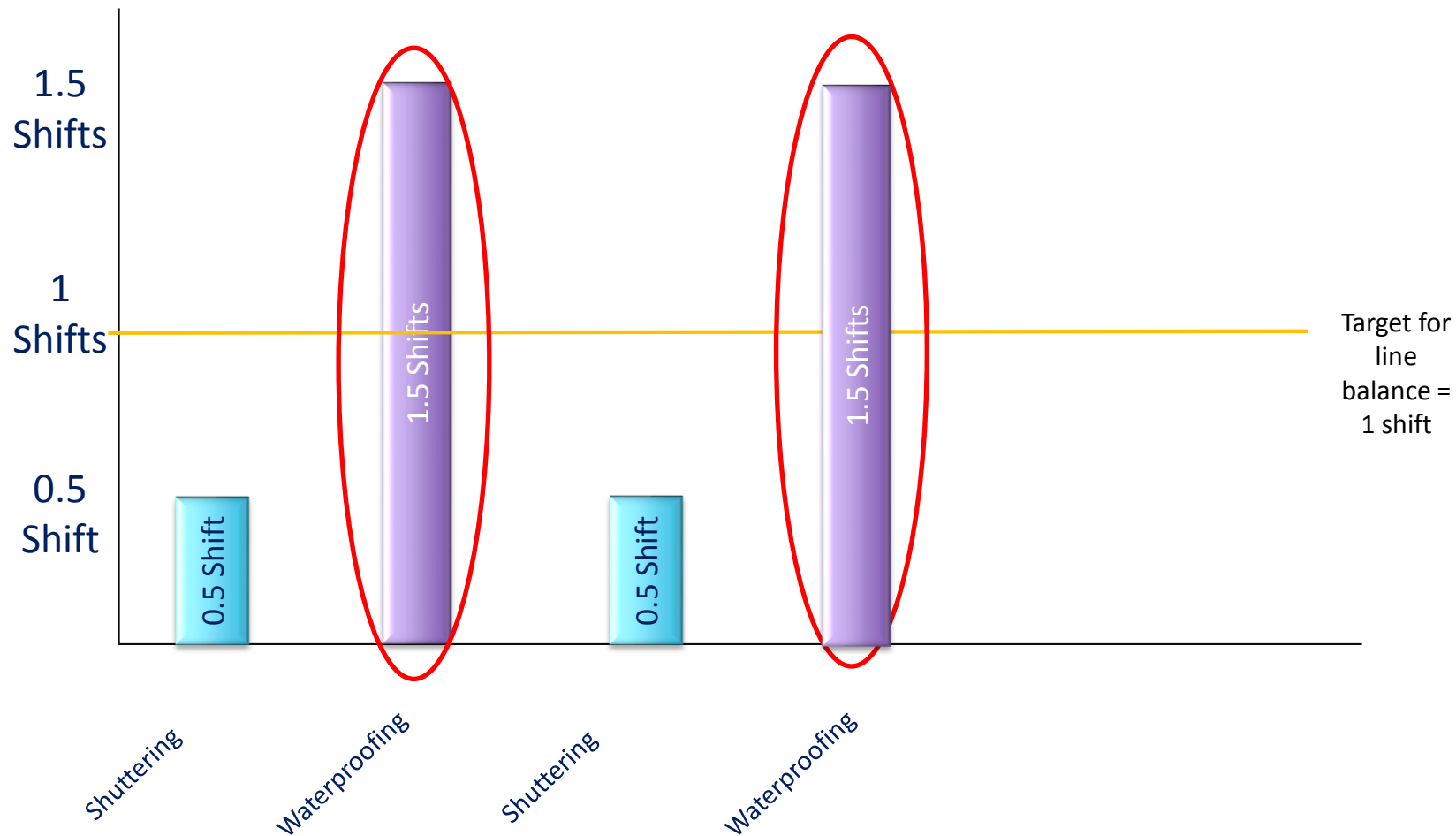


Lean Improvement Techniques

1. Line of Balance exercise used to benefit the programme



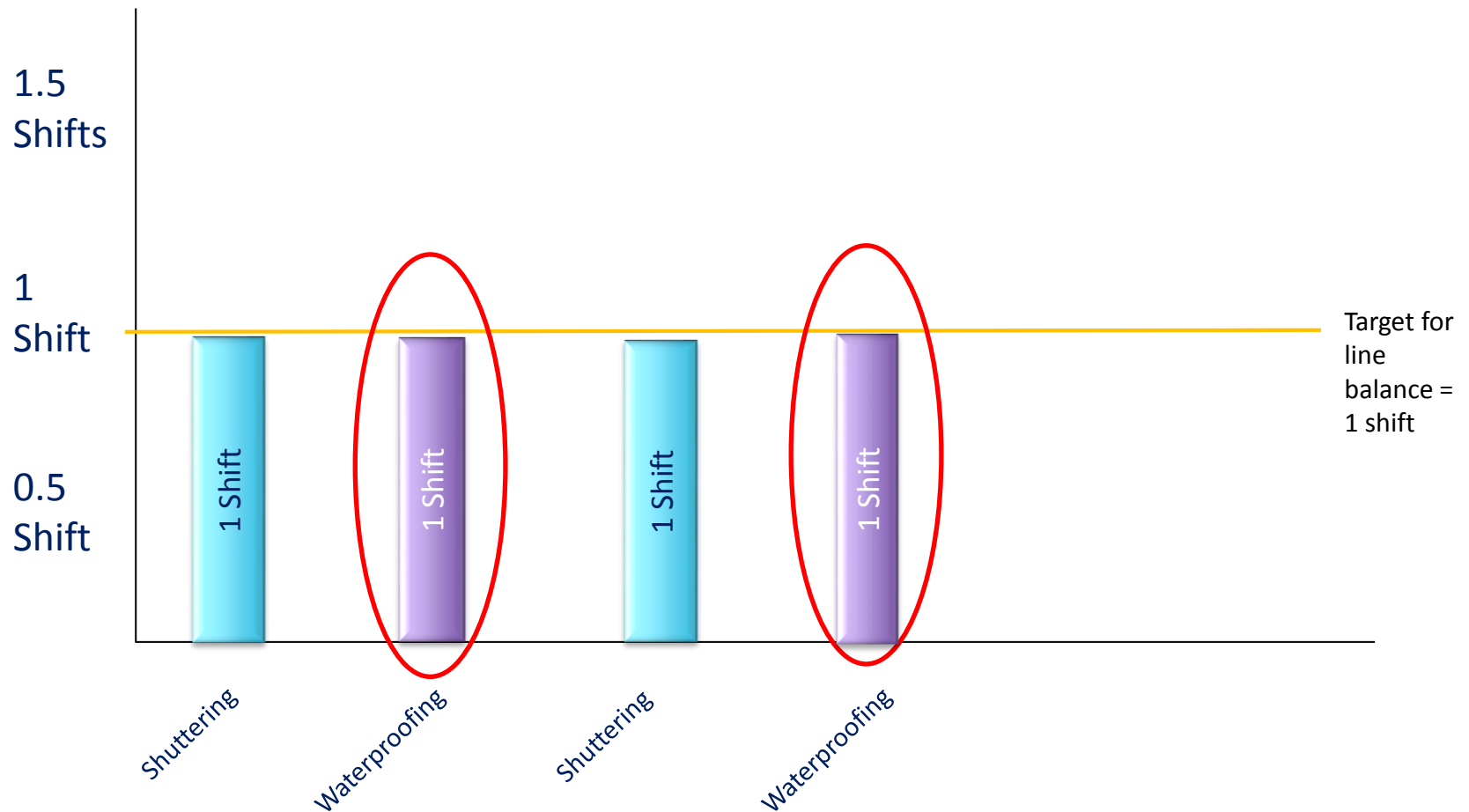
Balancing the plan



Methods of balancing the plan

- Eliminate waste
- Increase resources
- Decrease resources
- Re-engineer the process
- Re-allocate sub-tasks
- Automate the process
- Produce parts of the building off-site

Balanced Plan Introducing Night Shift – 3 Pours in one week



Investigation details							Current status		Improvement results					
Item number	Item start date	PIT and group	C32 Ref	Programme item	Current programme info	Details of improvement investigation	Target time saving	Target cost saving	Details	Key areas improved	Actual time saving	Actual cost saving	Completion date	Comments
PT/C360/001	15/05/2014	2	TRA103	402	Multi activities	Critical path protection scheme to help prevent delays to the critical path activities		0	Complete	Awareness of the critical path activities	initiated potential 3 days delay	15000	01/08/2014	
PT/C360/002	14.03.2014	2		402	Roofing, brickwork, solar panel activities	Sequence of works to the plot roofs, also standardising heights of scaffolding	2 - 3 days	3 - 4k	Complete	Revisits and adaptations to main scaffold to the plots	saved 2 days	£2,649 per day	14/06/2014	These figures are based on 1 plot
PT/C360/003	07/07/2014	2	Various	402	Multi activities	Provision of a hydraulic breaker throughout Phase 4 to enable quick removal of obstructions			Ongoing (Plot 8 remaining)	Obstructions removed quicker, preventing programme slippage				
PT/C360/004	01.09.2014	2		402	Scaffolding	Removal of the 2nd lift platform to the boundary wall scaffold	2 days		Trial to be carried out on the next section of wall to plots F + D					
PT/C360/005	01.09.2014	2		402	Scaffolding	Loading bays to plots C + E will reduce from 2 bays to 1 when we incorporate the scaffold around both plots	1 day		Awaiting progression of bricklaying					
PT/C360/006	02.07.2014	1	AB1028	404	Install Street Piles to Elevator Street Shaft	Replacement of crane power plant for the (Glen Siler) Piler with a track mounted power pack to reduce usage of the crane	3 days	£50,000	Complete	Due to the size of the site the operation was safer as it reduced the required number of lifts.	3	£30,000	17/07/2014	Approximate subcontractor cost per shift is £30,000
PT/C360/007	9.9.14	1	AB1110	404	Installation of the Shaft SCL P2 Layer	The shaft P2 layer requires 30m3 of Concrete. The site also only has capacity for 30m3 with approximately 40m3 of material delivered a day as no deliveries allowed during the night. Previously time has been lost as there has been insufficient material. To keep up with demand and save the site mix for nights, CSU proposed to use an CRU approved SCL mix for the P2 layers without conducting on site tests.	10 days	£180,000	CRU acceptance for use of material obtained. Programme saving 6tc.					
PT/C360/008	01.09.2014	1	AB1110	404	Installation of A393 Mesh within the ash eye thickening zones.	The	2 days	£20,000	C360 FCD 00029 was accepted to CRU requesting that the design requirement for the Mesh to be removed as SPC would be used within the thickening zones.	Reliability and duration of activity. In addition the activity will be safer as less working at height in a confined space will be required.	2 days	£20,000	02/09/2014	Approximate subcontractor cost per shift is £20,000
PT/C360/009	06.10.14	1	CA610	404	Installation of the Shaft Earth Mat	Remove the requirement to install the earth mat within the shaft by having a separate earthing system that can be installed offsite of the programme critical path.	5 days	16C	Awaiting confirmation of acceptance of proposal at ME. CSU then to use that as leverage to secure acceptance for a surface earthing system at Elevator street.					
PT/C360/010	27.4.15	1	CA420	404	Level BS Mass concrete base	AsL to cast BS mass fill concrete up to invert level of the shaft drainage. This reduces the amount of temporary backfill required to be installed in addition to reducing the overall duration of the actual activity.	3 days	16C	Awaiting design confirmation of the lower level from C23. Deadline for receipt of this is required by 26.09.14					
PT/C360/011	Dec-13	2	Various	Multi - activities	The assessment and payment of the ISS takes time resulting from inaccuracy and verification of hours worked, job description, cost coding relating to hours on the allocation sheets. The allocation sheet is compiled by the foreman on site. The inaccuracy on the allocation sheet has led to inaccurate payments resulting in payment queries and unhappy labourers on site.	Ongoing	801.5k per 8 months	Ongoing	Improved quality of documents produced e allocation sheet, timesheet, assessment	Ongoing	8 months, £2,412.4k savings	Ongoing		
PT/C360/012	Jan-14	2	Various	Multi - activities	Identifying sharing the job roles through collaborative planning in order to reduce costs, have less people on site and better utilisation of resources. Sharing roles examples, utilising Cleaner as store man, Security Guard as Bankman, Groundworker as bankman	Ongoing	£136k	On going	Improved quality of work and people not bored by doing one task			Using Security Guard as Bankman / TM saves +£176 393.00 Cleaner as Storeman saves +£50,607.00	01/08/2015 (14 months)	
PT/C360/013	Mar-14	3	MEP C3A Piling	2 weeks	Operation improvements to reduce programme to be implemented at ESS			Complete	Concrete delivery/testing improvements in site set-up could allow at least an additional job per day. Offsite pre-assembly of piling rig prior to starting on site to identify problems and reduce start-up time on site. Clear crane control plan to allow cranes to install cages in all locations to improve rig utilisation.	Potential for 3day saving at MEP		potential for £20k on programme/ overhead time at MEP	Jul-14	
PT/C360/014	Jan-14	3	Improving the secondary concrete lining programme		To improve the overall secondary concrete lining programme at Eleanor Street Shaft by reducing the time taken to complete the sheet waterproofing membrane by implementing improvement measures put in place following the completion of Mile End shaft			Complete	1. Secondary concrete lining subcontractor to get a team of direct labour trained up in the application of the sheet waterproofing membrane by the manufacturer as they are not dependent on their waterproofing subcontractor. This team would be permanently site based during the secondary lining works and will carryout other duties in the secondary concrete lining process when not applying the waterproofing. This will provide greater flexibility with the site team to accommodate change caused by unforeseen events e.g. change of weather, design, on site constraints etc. - Further work will be required by the CSU team to look at the proposed improved working practices identified following the completion of Mile End Shaft secondary concrete lining to further reduce the construction programme at Eleanor Street.	1.2 weeks potential	4,500/week potential	Jun-14		
PT/C360/015	06.06.2014	3		Construction of the shaft walls	Analyse the output data across the individual construction activities at Mile End and develop the improved working practices to the Eleanor Street shaft walls construction. Change design to reduce complexity of construction to reduce programme time and costs.			Ongoing	This work was chosen as the shaft wall is one of the most critical activities on the project and time saved here is time saved across the whole project.					
PT/C360/016	Aug-14	3	Headroom Roof Slab											
PT/C360/017	Aug-14	3	Top of shaft waterproofing detail											
PT/C360/018	05.08.2014	3		Emergency crane	Use of the emergency crane to load the ERCD system dismantled on the truck. Main crane not affected by these activities.			Complete.						

MileEnd PIT – Improvement Tracker

Improvement Summary

Q&A