national highways | smp alliance

Alliance Lean Production System (ALPS) Playbook

Foreword by Professors Glenn Ballard and Lauri Koskela

Our guide to successfully embedding a culture of sustainable continuous improvement on infrastructure projects.

March 2025

Acknowledgements

This Playbook would not have been possible without the input and support from many people within the seven SMP Alliance partners who are:

- National Highways as the Client
- Jacobs and WSP in the UK as Digitally Enabled Designers (DED)
- Balfour Beatty, BAM UK & Ireland/Morgan Sindall Joint Venture (bmJV), and Costain as On-Site Assembly Partners (OSAP)
- Fluor as Production Management Partner

We also want to thank our diverse Supplier Network of over 100 companies, but specifically Lean Construct Ltd for their support and guidance to help us achieve ISO 18404 certification.

Special mentions for Jen Hutt for her HELMA and Lean enabled efficiency contributions and Joanne Cowell, who were the first certified ISO 18404 Lean Practitioners. They were followed by Jonathan Marsh, Jonathan Smedley, Rebecca Christie, and Barry Jacks who all went the extra mile to complete their portfolios. Thank you to the rest of the ISO 18404 Lean Practitioner candidates who are still on their portfolio journey — remember you cannot fail, you can only give up!

We could list hundreds more people who have led and participated in our Lean journey since we mobilised in May 2020, but you know who you are and we thank you!

We also acknowledge Professor Peter Hawkins for coining the term ‘high-value creating teams’ as the next iteration of high-performance teams.

Special thanks to Professor Glenn Ballard and Professor Lauri Koskela for their Foreword, and to our graphic designer Marlijne Quentemeijer for her creativity and patience getting this Playbook ‘done, done’.

Lastly, since 2022 we’ve given out quarterly and annual Ou7come awards recognising the achievements of more than 80 different individuals and teams who’ve helped us meet our Six Outcomes. However, we want to recognise and thank our awesome People and Communications Team who’ve done so much to promote the achievements that we (SMP Alliance) are so proud of. Thank you, Neal Anderson, Steve Bird, Steve Butt, Flori Ball, Gavin Knight, Andrew Dewar and the rest of the team for all your hard work over the years.

All the best,
SMP Alliance Lean Production Steering Committee

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Foreword

By Professors Glenn Ballard and Lauri Koskela

This publication provides a very detailed account of what was done on a major National Highways Alliance to develop a continuous improvement culture. We think this kind of a description of a Lean implementation case is very valuable for practitioners and learners. It has much content. We highlight here a number of especially new, interesting and/or useful nuggets of advice or experience.

'Developing our People' is one of the three main areas of the Lean implementation in the Alliance. This of course resonates with the popular slogan of Toyota as a people development company. The goal was to have 80% of the Alliance staff trained at the appropriate level. A rich variety of ways of training was used: e-learning, training events, simulations, coaching, learning by doing. Especially various simulation methods were advantageously applied, for different learning outcomes. The Lean training was extended beyond the staff coming from the Alliance companies to the Supplier Network of more than 100 suppliers.

One could ask how rational it is to invest into such a massive training effort in an Alliance with a limited lifetime. However, the calculated ROI of this Lean implementation is given to be 30:1, thus training has clearly led to excellent outcomes. And of course, all the staff of the Alliance are taking the acquired competences to their next endeavours.

Everyone who has used the Last Planner System will recognise Should-Can-Will-Did as fundamentals of project planning and control systems. The SMP Alliance Playbook adds Might to those fundamentals. From beginning to end of a project, both risks and opportunities are explored collaboratively. This shifts the focus from doggedly striving to keep to a detailed schedule to identifying alternative pathways from where the project is in its flight to where it is wanted to be. To support this shift, several processes are presented in the Playbook: most centrally, a process called IRMA 360 (Integrated Risk Management Approach) and Flow Walks, where flows are the standard inputs for tasks, e.g., information, materials, etc.

Lean and Learning have more in common than their first three letters. Without Learning, continuous improvement is impossible. The Playbook offers many ways to learn and solve problems. Some have been around and in use for quite a while, but the Playbook has suggestions how to use them effectively.

IGLC 2019 'Meet the IGLC Godparents' with (L-R) Professors Lauri Koskela, Iris Tommelein, IGLC 2019 Chair Paul Ebbs, and Professors Greg Howell, Glenn Ballard, and Luis Alarcon.

Foreword

By Professors Glenn Ballard and Lauri Koskela

The Playbook also offers a new way to learn: Direct work observations (DWO), which focus on waste identification and removal in selected processes.

To further awaken your interest, here are the Playbook's tips for conducting a DWO:

Six tips to conduct a DWO

1. Identify and understand the process for study. This is a critical activity to define production rates and productivity baseline.
2. Plan the study, communicate and engage. Assemble a team, and agree what you will do, when, where, how and with whom. It is very important to engage with the construction team (The Value Creators) and teach them how to observe themselves. doing it 'with them' not 'to them'.
3. Conduct the study with the Value Creators. Capture the situation on the ground as it is. Review the recorded data with colleagues.
4. Analyse and define improvements, and identify and quantify value adding, support activity and waste. Use this information to define an improved method. Share this information with the Construction Manager and wider team, they are the best people to suggest improvements.
5. Trial and prove improvements before implementing improvements. Observe and monitor the results to refine the method.
6. Standardise the improved method. Review the process with colleagues. Are further improvements required? Develop and agree the standard operating procedure. Consider cascading to other teams doing a similar process.

bsi.

Certificate of Registration

Royal Statistical Society Certification Scheme for demonstrating compliance to ISO 18404:2015

This is to certify that:

National Highways | SMP Alliance
Bridge House
1 Walnut Tree Close
Guilford
GU1 4LZ
United Kingdom

Holds Certificate Number: RSS 783330

and operates a management scheme for demonstrating compliance to ISO 18404:2015 for the following scope:

Please see scope page.

For and on behalf of BSI:

Matt Page, Managing Director Assurance - UK & Ireland

Original Registration Date: 2024-05-30
Latest Revision Date: 2024-06-12

Effective Date: 2024-05-30
Expiry Date: 2027-05-29

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...making excellence a habit.

Certificate No: RSS 783330

Registered Scope:

The application of Lean to the Design and Construction of SMP Alliance Programmes and Schemes.

Key personnel:
1068 Paul Ebbs
1071 Noor Alhour
1070 Rob Sanger
1072 Chris Wearne
1073 Jenny Hutt
1074 Joanne Cowell
1053 Stephen Williams
1041 Stuart Anwyl
1002 Steve Ward

Original Registration Date: 2024-05-30
Latest Revision Date: 2024-06-12

Effective Date: 2024-05-30
Expiry Date: 2027-05-29

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BSI ISO 18404:2015 SMP Alliance certificate of registration.

Introduction

The opportunity afforded by Lean Thinking to the design and delivery of infrastructure construction projects is extraordinary, with the global track record for the percentage of projects on time and on budget falling between 2% and 40%, SMP Alliance set out to create an Alliance Lean Production System (ALPS) and embed Lean Thinking throughout the organisation. It used the new standard ISO 18404 as the model for deployment. The outcomes included significant cost savings, projects delivered early and up to 66% improvement in productivity. The Lean Production Steering Committee created this Playbook to record how we approached the task of Lean deployment in an organisation consisting of >1500 employees from across seven organisations plus an extensive supplier network with an overall value of approx. £1.2 billion. We are very proud of the achievements of all involved and hope this document may serve as a useful guide to others seeking to develop an effective deployment of Lean construction across a large organisation.

We hope you enjoy reading and learning from this Playbook. We have borrowed and adapted many tools and techniques from others, and we hope you do the same from this. Good luck!

Receiving certificate from BSI at the annual Alliance internal event.

How we gained buy-in from Alliance leaders

Getting buy-in to any initiative can be hard, and Lean is no different. The key point is to make the journey fun. Leaders appear at all levels of an organisation from frontline supervisors to the Managing Director, and their characteristics vary from informal to charismatic and influential. The concept of Lean Leadership means leaders must actively participate in, and lead, Lean deployment.

In the Alliance we achieved buy-in through:

- Engaging our mid/senior leadership during programme/project kick-offs (p. 20) and various events through simulations (p. 17).
- Developing a nucleus of emerging leaders through ISO 18404 Lean Practitioner training (p. 18 & 19).
- Making Elmo part of day-to-day project management (p. 42).
- Capturing, sharing and embedding current best Lean practices from Alliance partners (p. 46).
- Investing time and effort in communications planning and delivery (p. 47).

After a two-day project kick-off Kirk Roderick, a Works Superintendent, said:

"In 17 years I've attended this type of workshop on numerous occasions (rough guess 30-40+) and I can honestly say this is the one I have had most out of. The way the two days were explained on day one and set out, the facilitators, the audience, from start to finish I thought everything was a big success. Also found a few who got very attached to Elmo!"

Alliance Project Leaders signing up to deploy our ALPS.

Our Lean achievements roadmap

2019

Annex G produced **March 2019**

ISO 18404* tender commitment **July 2019**

2020

SMP Alliance* mobilised **May 2020**

2021

HELMA* (1.7/4) **September 2021**

2022

HELMA* (2.3/4) **September 2022**

Steering committee formed and **Lean Strategy** developed **September 2022**

SVD* finishes **6 months early** **September 2022**

24% CO_2 emissions savings **September 2022**

2023

£9.3m Lean enabled **efficiencies** **March 2023**

HELMA* (3.1/4) **September 2023**

M40/M42 delivered **3 months early** **November 2023**

5 Emergency Areas **delivered in the time allocated for 3** on M1 J32-35a **December 2023**

2024

Becoming the **4th organisation in the world** and the **1st alliance** to achieve certification to **ISO 18404*** **March 2024**

2 ISO 18404 Lean Experts
3 Leaders
2 Practitioners certified **March 2024**

£50.5m Lean enabled **efficiencies** **March 2024**

2 papers published by the **IGLC*** **June 2024**

300+ Elmo's distributed **June 2024**

Final NEAR* design delivered **3 times faster** than the first **June 2024**

M42 J4-7 **2 months early** **August 2024**

HELMA* (2.3/4) **September 2024**

In **October 2024 HELMA* score was 25% above any other organisation** using a revised tougher format than 2023

150% improvement on NEAR* North EA* installation baseline rate **November 2024**

2025

27 KTPs produced up to **February 2025**

133 completed e-learning up to **February 2025**

4 ISO 18404* Lean Practitioners certified **March 2025**

1m hours LTI* free NEAR* North **March 2025**

£80.5m Lean enabled **efficiencies** up to **March 2025**

250+ different attendees across 13 Let's talk about Lean webinars **March 2025**

ALPS Playbook published **March 2025**

During the wrap up of the BSI (British Standards Institute) Stage 1 ISO 18404 audit in February 2024 Tony Slater, the Alliance Managing Director, noted:

"We are embedding Lean as 'the' thing not 'a' thing we do to help us achieve our vision, mission and outcomes (Strategy). Lean is now part of our DNA and the next time we start an alliance it has got to be from day one. We are now setting a new benchmark for infrastructure performance; every project before us overran."

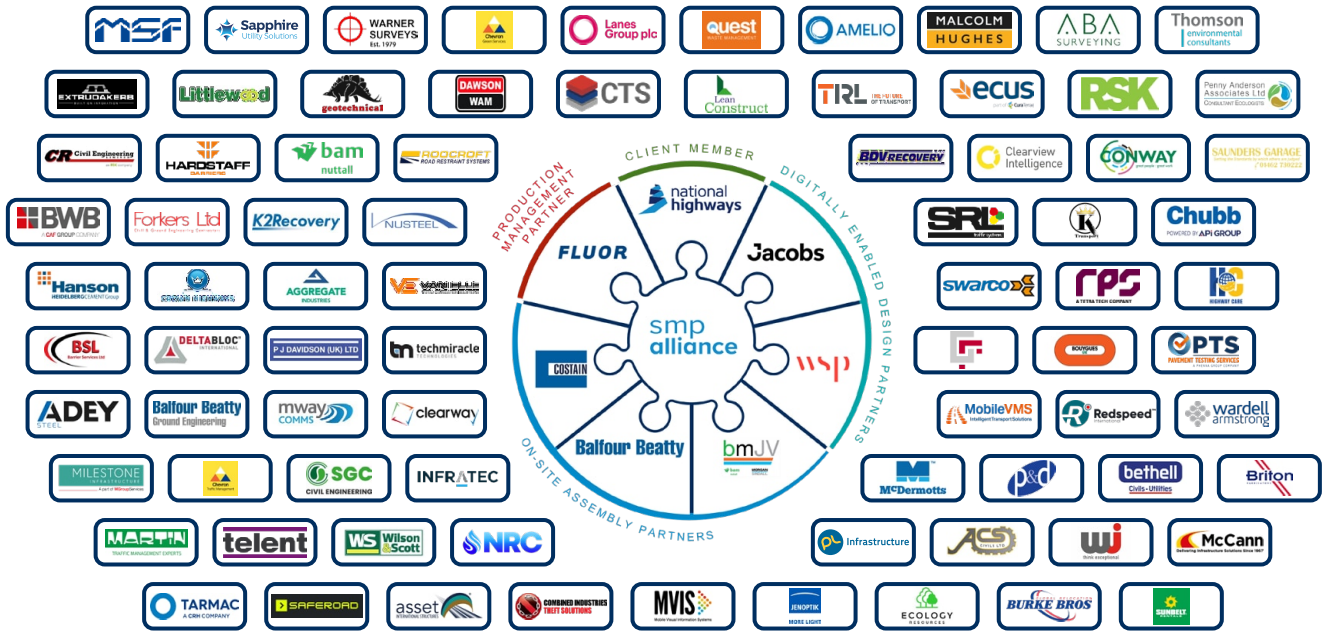
* All acronyms can be found in the glossary.

About SMP Alliance

SMP Alliance is a unique integrated enterprise comprising National Highways as the client; Fluor Corporation as the production management partner; Jacobs and WSP in the UK as the digitally-enabled design partners; Balfour Beatty plc, bmJV (the BAM UK & Ireland/ Morgan Sindall Construction & Infrastructure Joint Venture) and Costain Group PLC as the three on-site assembly partners.

Together, these organisations worked collaboratively with over 100 suppliers using the Project 13 Network delivery model, along with a programmatic approach and contemporary practices, such as digital innovations and off-site manufacturing.

Project 13 is an industry-led response that adopts a new business model based on an enterprise (not on traditional transactional arrangements) to boost certainty and productivity in delivery, improve whole life outcomes in operation and support a more sustainable, innovative and highly-skilled industry.



Scan the QR code for a video about the Stopped Vehicle Detection (SVD) retrofit programme case study.

Our Vision

To be industry-leading in making infrastructure safer, greener and evermore efficient for everyone.

Our Outcomes

- Home Safe and Well
- Enhanced Environments
- Production Excellence
- Confident Customers
- Inspiring Workplaces
- Enriched Communities

Our Mission

To be a high-performance enterprise that excels in delivering enhancements to the strategic road network.

Our Values

Be Brave

Do the Right Thing

Lean contractual requirements

The Alliance contract had a four-page Annex (G) which specified the expectations for Lean deployment across the Alliance. Whilst this did not specify how to deploy Lean it was framed around outcomes and benefits which included safety and customer (i.e., the road user). There were **nine key areas**:

1. Deliver successful schemes
2. Generating tangible benefits
3. Safe and customer focused
4. Learning and sharing good practice
5. Visible Lean Leadership
6. Visible and proactive adoption of innovative working methods
7. Visible metrics and production data
8. Engagement and embracing Lean
9. Strategy deployment

The Alliance chose ISO 18404 as the model to realise the tangible benefits and outcomes from Lean deployment that Annex G called for.

There was also specific requirements in Annex G that related to a Lean maturity framework called Highways Excellence Lean Maturity Assessment (**HELMA**), as well as **collaborative planning**, **visual management**, and **Lean culture assessments**. These were updated in 2024 with more stringent criteria to help raise the bar of Lean deployment. National Highways have been developing and deploying these since 2009.

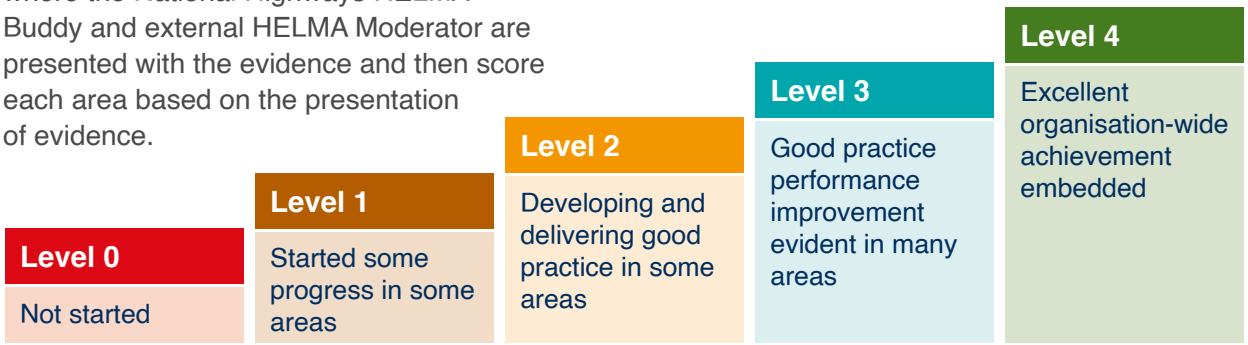
Scan the QR code to view the National Highways Lean Guidance.

HELMA is divided into **10 topics**. Each topic has several descriptors (definition statements) that must be met before moving to the next HELMA level. Suggested evidence for each level is also provided as a guide. The HELMA framework has **two key parts**:

1. **Self-score and submission.** This is conducted internally against each descriptor and a pack of evidence is produced for review prior to the moderation.
2. **The moderation.** This is a one-day event where the National Highways HELMA Buddy and external HELMA Moderator are presented with the evidence and then score each area based on the presentation of evidence.

10 HELMA topics

- Integration of Lean and business strategy
- Lean Leadership and engagement
- Deployment management and infrastructure
- Voice of the Customer
- Value streams and processes
- Methodologies and tools
- Competencies and capabilities across the organisation
- Performance improvement and delivery of outcomes
- Continuous improvement culture
- Supplier engagement



5 levels of the Highways Excellence Lean Maturity Assessment.

Meet our Lean Production Steering Committee

The Lean Production Steering Committee was responsible for Lean deployment, which included preparing for and showcasing our journey at the annual HELMA moderation.

Over 125 years of Lean expertise and 250 years of construction sector experience was harnessed from the Alliance partners to form the Lean Production Steering Committee in September 2022. We met over 50 times to co-create our Lean Strategy and Alliance Lean Production System, whilst also monitoring Lean deployment across the Alliance and adjusting our Strategy and direction where required to support our Alliance Strategy and Production Delivery Plan.

Whilst we have provided the many examples, hints, tips and tricks in this Playbook, many others from right across the Alliance (including our Supplier Network) have made other significant contributions.

If you are starting on your Lean journey, consider who has sufficient Lean knowledge and experience in your organisation or project to form your steering committee.

We propose three key steps for success:

1. Commit to meeting once a month to update and revise your Lean Strategy. You may need a longer meeting every other month.
2. Co-create your Why (purpose), What's (goals), and How's (initiatives) and share the responsibility for achieving these.
3. Make Elmo part of your team – see p. 42 for more tips!

The Lean Production Steering Committee

Elmo
International Guest of Honour
at Lean meetings
5 years' Lean experience

Nour Al Hour
ISO 18404 Lean Leader & Lean Coach
11 years' Lean experience

Rob Sanger
ISO 18404 Lean Leader & Lean Coach
11 years' Lean experience

Paul Ebbs
ISO 18404 Lean Expert & Lean Coach
15 years' Lean experience

Chris Wearne
ISO 18404 Lean Leader & Lean Coach
14 years' Lean experience

Stuart Anwyl
ISO 18404 Lean Expert & Lean Coach
25 years' Lean experience

Emma Wilson
Senior Site Agent ISO 18404 &
Lean Practitioner Candidate
1 year's Lean experience

Rebecca Christie
ISO 18404 Lean Practitioner
& Internal Lean Auditor
1 year's Lean experience

Stephen Williams
ISO 18404 Lean Expert & HELMA Buddy
9 years' Lean experience

James Dunne
Lean Six Sigma Black Belt &
Lean Construction Manager
9 years' Lean experience

Simon Crisp
ISO 18404 Lean Practitioner Candidate &
Senior Construction Manager
2 years' Lean experience

Steve Ward
ISO 18404 Lean Expert
25 years' Lean experience

What is the ALPS Playbook?

Welcome to our Lean Playbook! The following sections share the development and deployment of our ALPS between 2020 and 2025. Our ALPS is basically everything we've done to make Lean stick and become business as usual. The foundation of our ALPS was **ISO 18404** – an international standard for Lean that has **two parts**:

1. A competency framework of hard and soft skills that people become certified to in the UK by the Royal Statistical Society (RSS) following a rigorous portfolio development and assessment process.
2. A series of clauses within ISO 18404 normative to ISO 9001 to externally audit an organisation's Lean Management System against.

In short, becoming certified to ISO 18404 is far from a tick box exercise as there are **three main areas** that must be demonstrated through a series of external audits:

1. How does your **Lean Strategy** support achieving your organisational goals.
2. How your **Lean architecture** is being deployed which includes initiatives such as training and coaching plans, the use of appropriate Lean tools, deployment monitoring and review mechanisms, communication plans and leadership engagement.
3. What are the **'so what' continuous improvement benefits** from Lean deployment.

There are **three core ALPS elements** which we will expand upon in this Playbook:

We codified these three elements as our ALPS as it has helped us achieve challenging targets while also realising strategic goals (our Outcomes).

The purpose of our Lean Strategy was to embed a culture of sustainable continuous improvement. This Playbook showcases how we have done this from our commitment to Lean principles and practices in 2020 (supported by Annex G) through to certification to ISO 18404 in 2024. You will see how the design and delivery of major infrastructure projects and programmes was supported by our ALPS including how we started and sustained our Lean journey and achieved our strategic goals along the way. We will share the lessons, hints and tips we've learned by living our **Alliance values** – **being brave** and **doing the right thing** – as we deployed our ALPS.

Whether you're curious about Lean, embarking on your own Lean journey, or you are an experienced Lean Practitioner, we hope our ALPS Playbook serves as a source of inspiration, guidance, and practical wisdom that you can you use on your project or within your organisation.

Our Lean Strategy

Background and evolution

Our Lean Strategy was collaboratively developed and deployed by our Steering Committee with different members leading various initiatives (How's). We took a 92-page Benefits Realisation Plan (Level 1), created a single page Lean Strategy (Level 2) and then created Level 3 strategies for more complex initiatives (How's) such as Lean training & coaching, collaborative planning and visual management and more specifically make-ready planning.

This technique is known as Single Page Policy Deployment or Hoshin Kanri. The matrix on the right is a highly-simplified version of our Strategy. It has our Lean Strategy purpose (Why) and five breakthrough goals (What's) – #4 and #5 were added in February 2024 to reflect an updated Alliance Strategy. It also summarises our 16 initiatives into the three focus areas. **The links between How's and What's show the level of influence (strong, medium, weak) each 'How' had towards achieving each 'What'.**

The Red, Amber, Green (RAG) status of each strategic initiative was updated monthly according to SMART* targets and measures. The matrix shows an example of the RAG visual management. This structure helped ensure effort was directed towards specific 'How's' that required attention over others.

* Specific, Measurable, Achievable, Realistic, Timebound.

		How's (16 initiatives summarised into three focus areas)		
Why (Purpose)	To embed a culture of sustainable continuous improvement	Developing our people	Embedding learning by excelling at Lean tools and techniques	Sharing and embedding current best practices
What's (Goals)	**#1** Achieve BSI certification to ISO 18404 by March 2024	S	S	S
	#2 80% of people are at an appropriate level of Lean competency by March 2025	S	S	S
	#3 Efficiency savings: reduce cost by 5% through Lean projects by March 2025	S	S	S
	#4 Improve Lookahead Execution Index from 44% to 70% by September 2024	M	S	S
	#5 Effectively measure Right First Time by 11 September 2024	M	M	W
	SMART* target (example)	10 people certified by March 2025	All projects complete yearly assessments	One comms piece per month
	Measure (example)	% of people certified by March 2025	% of projects showing improvement	Done done or not
	Status (example)	**Late and requires attention**	**Behind but OK**	**On track**

A simplified version of our Lean Strategy.

Purpose (Why)	Breakthrough vital few goals (What's)	Focus areas (How's)
Alliance alignment through a clear purpose statement to 'embed a culture of sustainable continuous improvement'. Our Lean Strategy was grounded in the belief that continuous improvement is not a one-time effort but a cultural shift that must be embedded across the Alliance. Our purpose drove all our actions and decisions, ensuring that every team member and initiative was aligned towards creating long-lasting, positive cultural change.	These were SMART goals, challenging but achievable. Originally three goals in September 2022 but expanded to five after the Alliance Strategy was updated in July 2023. **Competency development** Building and enhancing Lean skills across all levels of the Alliance to ensure everyone is equipped to contribute effectively. **Efficiency generation (£ savings!)** Streamlining processes to create flow efficiency by eliminating undesirable waste, reducing cycle times, and optimising the utilisation of resources. **Quality and reliability Improvement** Focusing on delivering high-quality outcomes and ensuring reliability in our work, which ultimately drives next (internal) and external customer satisfaction.	Our execution strategy revolved around our three core focus areas but were supported by 16 specific initiatives (How's). Each of these initiatives were led by the steering committee members or 18404 Lean Practitioner candidates best placed to realise them. Each initiative had a SMART target and measure to easily track progress and a status box to update monthly with narrative and RAG rating. **Developing our people** Systematic training, coaching and hands-on experience to build an appropriate level of understanding of Lean principles for everyone across the Alliance. **Embedding learning by excelling at Lean tools and techniques** Mastering and effectively using key Lean tools and techniques to create shared understanding and embed a culture of continuous improvement. **Sharing and embedding current best practices** Ensuring that the latest lessons learned, and best practices are effectively shared and embedded within teams and across the Alliance.

Three focus areas of our Lean Strategy

The table below summarises key points within the three focus areas of our Lean Strategy and provides a little more context why these areas became our focus, what it practically meant, and how we went about delivering our Strategy. The rest of our ALPS Playbook details more examples from our deployment alongside links to external sources where you can learn more about Lean.

Focus area	Developing our people	Embedding learning by excelling at Lean tools and techniques	Sharing and embedding current best practices
Why was it our focus?	**The foundation of a sustainable continuous improvement culture:** • Our people led Lean by example to create lasting cultural change that fostered ownership, accountability, and engagement. • 'Ah-ha' moments were experienced through simulations and exercises followed up with practical implementation of tools and techniques to turn knowledge into understanding.	**The easy part, when leaders lead Lean by example:** • Core Lean tools and techniques helped people become Lean by doing Lean – not just thinking and talking about it! • Helping people become proficient in these tools ensured a consistent approach to problem-solving and process improvement. • Mastery of Lean tools empowered employees at all levels to actively participate in continuous improvement.	**To ensure our ALPS continuously improved:** • Effectively sharing the latest best practices so different teams learned from each other's successes and implemented/ improved other projects/peoples initiatives to become even better best practices. • By embedding the latest best practices across the Alliance, we became more consistent in task executions. • Lessons learned from one project/team was applied to others, multiplying the impact of Lean initiatives which avoided repeating the same mistakes.
What did it mean?	• Learning pathways were provided to develop people (starting with leadership) with sufficient knowledge to apply Lean principles to their role, function and/or project. • Continuous learning and practical application of Lean was encouraged. • We focused on establishing and maintaining high-value creating teams that worked together to expose issues, innovate and share the latest best practices.	• Excelling meant going beyond a surface-level understanding of Lean tools and techniques. • It involved a deeper, intuitive grasp of how and when to use each tool effectively, understanding the nuances and applying them to complex problems and using them as part of day-to-day project management.	• Systematic knowledge transfer between teams/projects/ programmes and across the Alliance. • Feeling safe to challenge and raise issues. • Celebrating problems as treasures so we could resolve them. • Engagement and participation in Lean deployment from the senior leadership to Value Creators in design and construction. • Using multiple communication channels to share successes and help people develop their own Lean knowledge.
How we did it!	• Used various Lean simulations such as Build a highway with Stickle Bricks, Villego®, and silent squares to develop knowledge of key concepts. • Trained and coached 48 ISO 18404 Lean Practitioners. • Conducted project and programme kick-offs and ad-hoc problem solving workshops. • Ran Supplier Network Lean workshops. • Delivered direct work observations coaching. • Developed and deployed a Lean e-learning module.	• Choosing By Advantages. • Creative thinking using de Bono's Six Hats. • Visual workplace organisation. • Collaborative risk management & planning incorporating key methods from the Last Planner® System with a heavy focus on make-ready planning. • Direct work observations. • Root cause analysis and problem solving. • Efficient meetings/workshops by using Elmo.	• Developed and implemented a Lean comms plan. • Published bi-annual Connec7 Lean 7imes articles. • Over 50 LinkedIn posts shared. • Facilitated 13 Let's talk about Lean webinars. • Conducted Internal ALPS audits and Moderated HELMA audits. • Populated our ALPS dashboard monthly. • Published 2 IGLC papers. • Developed 27 A3 Knowledge Transfer Packs and shared this learning through various channels.

Section 1

Developing our people

Developing our people to improve Lean competency

One of our **Six Outcomes** was '**Inspiring Workplaces**' recognising that the common denominator on every project is people. This Outcome largely focused on establishing and maintaining high-value creating teams through several inter-related initiatives such as leadership coaching, equality, diversity & inclusion (EDI) and social value. Lean competency development (training, coaching and doing) to ISO 18404 standards was identified early as a critical initiative. Subsequently we created two SMART breakthrough goals (What's) to develop our people:

1. Achieve ISO 18404 certification by March 2024.
2. 80% of the people working on the Alliance will be at a level of Lean competency appropriate to their role by March 2025. The pyramid illustrates our 5-level approach to Lean competency development.

The primary goal of Lean is achieving flow by utilising as small a batch/zone size possible. This is the key differentiator of Lean with other improvement methodologies such as Agile, Theory of Constraints, Six Sigma etc. Understanding flow (and the other Lean principles) is critical to understand and apply Lean successfully.

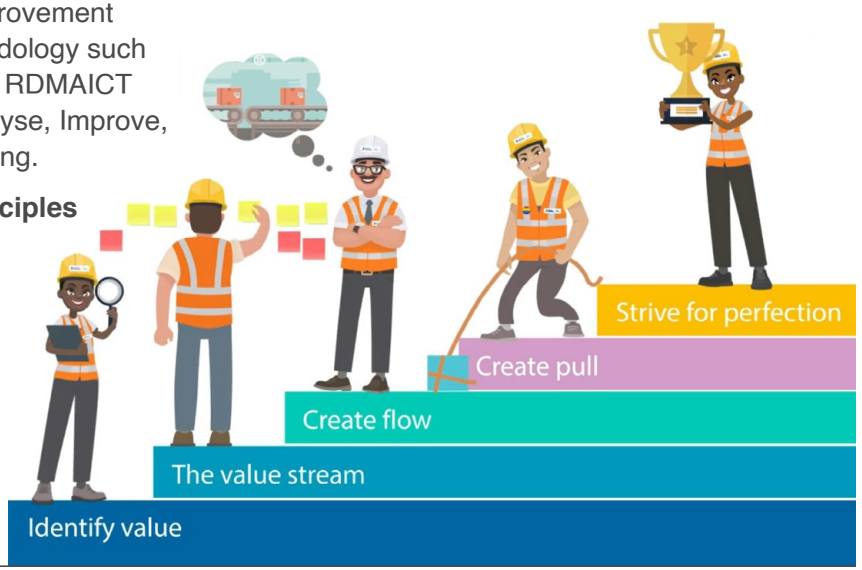
Lean training and coaching of individuals and teams gave our people sufficient knowledge and understanding of key Lean concepts to autonomously apply Lean to their role/function/team.The **two core pillars of Lean** are:

1. **Respect for people**
2. **Continuous improvement**

Respect for people is not just about being nice to others it also supports the principle that those '10 feet from a problem' are the ones that understand it best and most likely know how to fix it – so we respect everyone's experience and input.

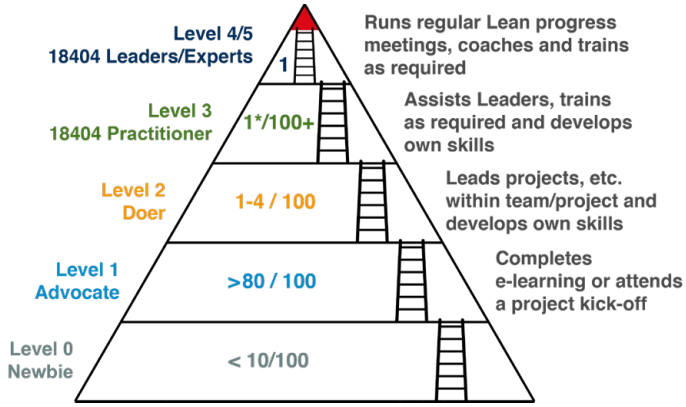
Continuous improvement (CI) seems like common sense, and you will find many references to CI in ISO standards, tender submissions, academic and industry papers etc. It could be simplified as the pursuit of excellence or just getting better at a task, but we can get better at doing the wrong thing, so when we put CI within the context of a Lean improvement project, we use a structured methodology such as PDCA (Plan, Do, Check, Act) or RDMAICT (Recognise, Define, Measure, Analyse, Improve, Control, Transfer) for problem-solving.

Understanding **the Five Lean Principles** are essential for sustainable and structured deployment.



The Five Lean Principles.

We used our training matrix model to guide how we would achieve our second SMART goal using the ISO 18404 Lean Competency framework at five levels.



Training matrix model guidance.

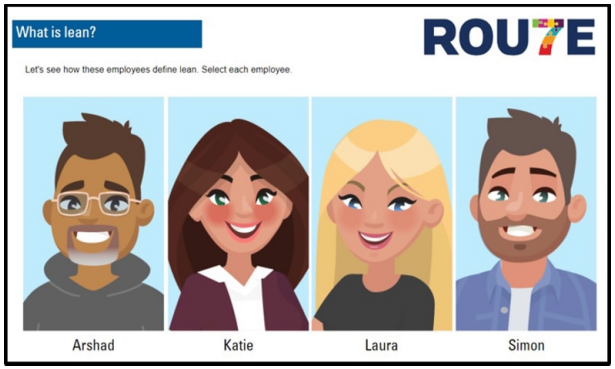
Lean training, coaching and doing

To help us achieve our SMART goal of having 80% of the people at an appropriate level of Lean competency we did several things by using both Alliance partner and external resources. This was a combination of:

- Modifying Balfour Beatty's Lean e-learning module and adding to our Learning Management System Rou7e.
- Using the Lean Construction Institute (LCI) UK's Lean Construction Development Pathway (LCDP) material.
- Incorporating Lean basics training using various simulations into project kick-offs, Alliance events with our leadership and Supplier Network, and prior to conducting direct work observations on site.
- Training four cohorts (48 mid-senior leaders) to ISO 18404 Lean Practitioner competencies over five days (level 3 in our pyramid) and coaching 11 of these through the portfolio development process (to apply what they learned to their role).

We used the ISO 18404:2015 Lean competency framework as our common language because it is an international standard that's sector agnostic. It also supported our first SMART goal to achieve ISO 18404 certification.

For our 75-minute (Level 1) e-learning module we added context, videos and soundbites from some of our leaders. Arshad, Katie, Laura and Simon's avatars were created after they



completed their five-day Level 3 ISO 18404 Lean Practitioner course, and they recorded 20-30 second audio clips sharing their role and what Lean meant to them. It helped bring Lean deployment to life from their perspectives.

Our e-learning was available to anyone within the Alliance, including our Supplier Network, 133 people completed this.

LCI UK launched their LCDP initiative in June 2022, with the Alliance part of the initial pilot. The LCDP Lean Practitioner modules were akin to Level 2 in our Learning Pyramid.

We used many simulations over the course of the Alliance ranging from minutes to a half day. Lean simulations are also great for helping build high-value creating teams.

We found that simulations are most effective when followed by action and application of the learning.

For example, conducting a direct work observation or a pull planning session after the Stickle Brick or Villego® simulations is an effective way to embed learning.

Our commitment to become certified to ISO 18404 required us to have an appropriate level of Key Personnel certified to the ISO 18404 Lean competencies.
This is demonstrated through portfolios of evidence that are assessed and certified in the UK by the RSS.

ROYAL STATISTICAL SOCIETY
DATA | EVIDENCE | DECISIONS

Knowledge ≠ understanding so if you want Lean to stick and become normal, doing Lean becomes more important than just knowing about it!

Lean simulations are an excellent way to make learning about Lean fun. Positive moods enable learning and knowledge retention. See Gloria Flores and David Umstot and Dan Fauchier's books for more on learning moods and simulations.

Scan the QR code to see Destin Sandlin's short backwards bicycle video for more about doing versus knowing.

Making Lean fun: Learning Lean through simulations

Simulations are a particularly fun way to learn about and retain Lean knowledge. They are also an excellent way to help establish and maintain high-value creating teams. Whilst many of the simulations we used in the Alliance were developed or adapted by those in the IGLC community, there are many other simulations and sources too. Besides developing Lean competency, we used simulations in many situations for different reasons:

- To help create and embed a culture of sustainable continuous improvement through a fun learning environment.
- To help get initial buy-in and engagement for Lean from our mid-senior leaders to Value Creators across the Alliance.
- As part of project and programme kick-offs as both ice-breakers and precursor to using a Lean tool.
- As part of our Supplier Network engagement and events.
- Weaved into the ISO 18404 Lean Practitioner Course.

The various simulations have specific learning outcomes. They typically have at least two rounds to simulate traditional practice versus Lean experiences. This helps with knowledge retention and aids group discussions. The National Training Laboratory's Learning Pyramid helps demonstrate why simulations are an effective learning method.

Our simulations included:

Build a highway with Stickle Bricks (5 Lean principles)

Villego® (Last Planner® System)

Marshmallow tower (target, value, design)

Magic stick (forming, storming, norming, performing teams)

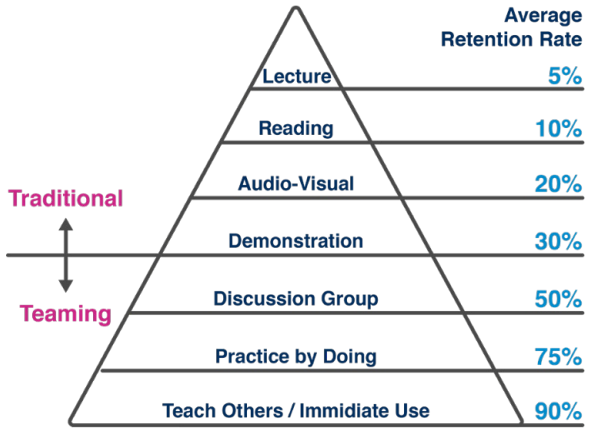
Paper aeroplanes (Standard Operating Procedures)

Lego ducks (clarity of purpose)

Silent squares (how to really collaborate)

Building a tower of paper (how fast teams form, storm, etc. to hit a target)

Scan the QR code for further reading on simulations in an IGLC paper.



The National Training Laboratory's Learning Pyramid.

Alliance leaders with Stickle Bricks (September 2023) and Magic Stick (November 2023).

NEAR pre-assembly kick-off with paper aeroplanes, July 2023.

Alliance leaders with silent squares, March 2022.

NEAR team building a tower of paper, March 2023.

ISO 18404 Lean competencies

ISO 18404:2015 sets out 18 Lean competencies. Thirteen of these are Lean Practitioner competencies with an additional five required for Lean Leader and Lean Expert certifications. They are a mixture of hard and soft skills that candidates must demonstrate through a portfolio of evidence. Depending on the level of individual certification there is a requirement to demonstrate compliance to each competency's criteria at **four levels**:

Understanding – implicit if there is a requirement to apply but articulation of understanding required by the candidate if not.

Applying – evidence of each competency's specific criteria being applied by the candidate.

The remaining two levels are mostly applicable to Lean Leader and Expert.

Managing – evidence of planning and controlling Lean activities.

Training – evidence of training and coaching others in specific Lean competencies.

The ISO 18404 standard defines and measures competence, not training. However, training courses are helpful, especially if people are new to Lean! The RSS are custodians of ISO Standard 18404 in the UK. They ensure the quality of approved training and review evidence created by the 18404 candidates. Any training body or individual can become certified by the RSS if they meet the criteria set out in 18404 competencies.

As the Alliance we took the decision to solely use the Lean criteria as the Six Sigma criteria did not align to the activities we expected to carry out. Six Sigma is therefore not covered in this Playbook!

Lean Practitioner, Leader and Expert competencies

1. History and benefits of Lean
2. Lean principles
3. Stakeholder management, communication skills and change management at individual and organisational level
4. Measurement of process performance
5. Creative thinking
6. Visual management and control
7. Workplace organisation
8. Team based process improvement
9. Implementing Lean through a structured approach
10. Data analysis
11. Lean implementation risk analysis
12. Sustaining Lean deployment
13. Motivating others
14. Managing productive time
15. Workload planning
16. Self-development
17. Lean techniques
18. Presentation skills

Lean Practitioner, Leader and Expert competencies
Additional Lean Leader and Expert competencies

> The Alliance achieving ISO 18404 certification has had a huge benefit on efficient delivery of projects. The tools used have helped us deliver what we say we are going to do and when we say we are going to do it, which is key to production excellence. However, it goes further than this, as at make-ready meetings we considered H&S elements to ensure we all got home safe and well. By delivering to time, we give customers confidence."
>
> **Simon Crisp, Senior Construction Manager, M6 J21a-26**

ISO 18404 key personnel, portfolio development and assessment

Organisational Certification to the ISO 18404 standard requires an appropriate level of key personnel to be able to deploy an Organisations Lean Management System (our ALPS). Key personnel are those individually certified to the ISO 18404 Lean Practitioner, Leader and Expert Competencies. Our approach to this was to certify our Lean Coaches first, followed by those who wanted to complete their portfolio after the five-day course. Certification to ISO 18404 Lean Practitioner, Leader and Expert takes significant effort, as it is a reasonably high bar to pass. However, the portfolio development process really helps embed the learning as it must be applied. An analogy is to learn a little and use it rather than learn a lot and lose it (unless you apply it!).

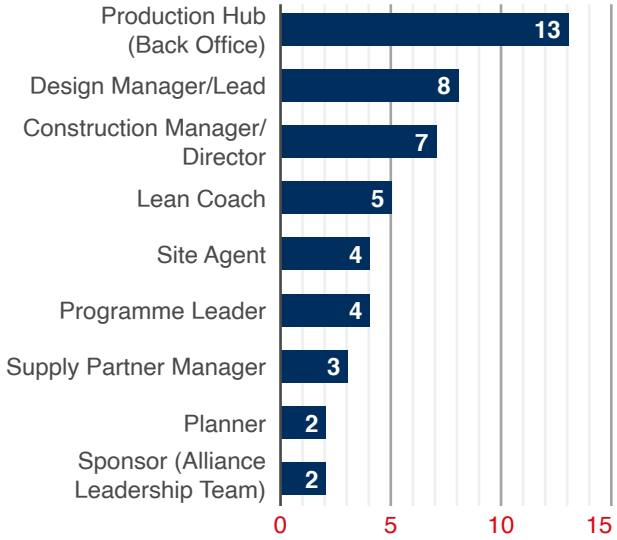
There is lots of research, case studies and literature about Lean Leadership – i.e., leaders leading by example by walking the Lean talk. We recognised the importance of, and need for, senior leadership taking an active role to embed a culture of sustainable CI.

Therefore, we took a senior leadership approach to ISO 18404 candidate and sponsor selection.

Whilst some of the 48 trained to ISO 18404 competencies left the Alliance for new opportunities, they took new skills with them. Those that remained formed a powerful community of practice who shared a common language and experiences about Lean.

This helped ease the roll-out of our Lean Strategy and, in particular, make-ready planning and direct work observations. Both are easy to deploy in theory but are very difficult to deploy and make normal practice without Lean Leadership and Lean culture in place.

Roles of Alliance 18404 candidates



> “Producing my portfolio really embedded the learning.”
>
> **Barry Jacks, Head of Technical Assurance**

In Steve Ward’s PhD research, he identified 23 potential success factors for sustaining Lean deployment, 13 of which were deemed critical. Seven of these directly relate to leadership and include:

1. Buy-in from senior management.
2. Management must be (Lean) capable.
3. Senior management must be directly involved.
4. Management must stay focused.
5. People must be allowed to spend enough time on improvement.
6. The right facilitator is required.
7. Must be a no-blame culture.

Second cohort of 18404 candidates, April 2023.

Project kick-offs: Establishing and maintaining high-value creating teams

Project teams are essentially temporary organisations who must mobilise, deliver, handover and demobilise over a short period of time. This phenomena is one reason why establishing and maintaining high-value creating teams that co-create their vision, mission, shared goals, communication protocols etc. is critical before delving too deep into Lean tools. That said, Lean tools are a great way to facilitate essential conversations and create shared understanding in a team, so we introduced core Lean concepts and tools through simulations.

In our Alliance we co-created team charters aligned to our overall Strategy (p. 8). We did this through consensus building using a few simulations to make the workshops fun, and Post-it note exercises to align on some very important concepts and outcome criteria.

We had many Lean kick-offs at the start of programmes and projects. They served many functions, including peer-to-peer learning about pilot Lean initiatives.

For example, as a Steering Committee we co-created our ALPS, however, before we deployed it on more than a dozen projects, we asked project leadership to sign up to the various elements such as project kick-offs, initial pull and make-ready planning sessions, and when Elmo would join project meetings (p. 6).

Digby Christian, a Project Leader at Sutter Health (a pioneering US Client Organisation in the field of Lean and Integrated Project), maintains “Lean is the hardest simple thing you will ever do.” He is right but that’s not to put anyone off starting, but, more to emphasise the importance of Lean Leadership, and approaches to establishing and maintaining high-value creating teams.

Lean tools and techniques are the easy part, but, one of the best ways to learn and understand them is to continuously use them.

Scan the QR code to check out the short YouTube video from David Marquet who explains how to achieve team alignment through a concept of ‘shared intent leadership’.

David’s book *Turn the Ship Around!, a true story of turning followers into leaders* has more detail.

There are lots of other useful YouTube videos and aligned reading. Many parallels can be drawn from these books, videos and other sources to help improve team dynamics and ultimately performance.

Scan the QR code for a ‘Let’s talk about Lean’ video about our NEAR Midlands project kick-off.

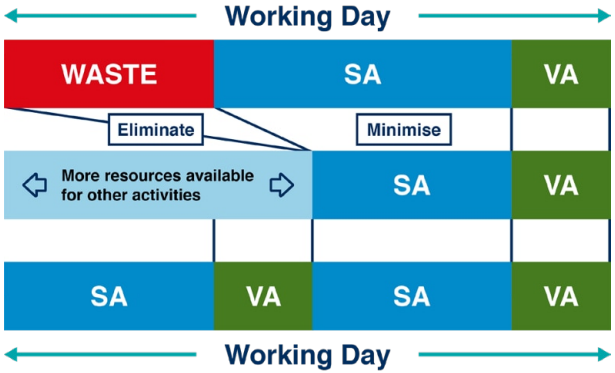
Understanding value, flow and waste

The purpose of Lean is to help **value flow** to **customers reliably**. There are four main points to expand on briefly to help understand the difference and alignment between flow and waste.

Value is delivered when something changes. For example, when a design is Issued For Construction (IFC) or when a duct pipe is being laid. To understand what's of value, it is helpful to absorb two simple equations:

Activity = work + waste

Work = value adding + support activities



The definition between value adding (VA) and support activities (SA) can be a little ambiguous. Value adding is when the 'flow unit' transforms from one thing to another e.g., the act of laying the duct pipe. Support activities are those that need to happen, but can perhaps be made more efficient e.g., transporting and unloading of duct pipe to site.

The goal is to maximise the available time for the Value Creators (p. 23) to conduct value adding work, whilst reducing support activity time and removing any unnecessary waste.

Unnecessary is emphasised because value must be understood from each customers' perspective before considering what waste to remove. More importantly, the concept of **resource efficiency** versus **flow efficiency** needs to be understood.

Niklas Modig and Pär Åhlström explain this very simply in their book *This is Lean* and on YouTube (scan the QR code).

In *This is Lean* the concept of the flow unit is shared from two different efficiency perspectives – resources and flow. An example of resource efficiency is digging a 100m long trench to keep the plant and operator busy whilst the pipe bedding and pipe fitting follows at a slower rate. From a flow efficiency perspective, the focus turns from keeping the resource 'busy' to identifying the slowest operation. This may be the backfill and/or pipe testing rather than the digger. By understanding the slowest process and improving that, the overall process will go faster. However, by improving any other process only superficial 'efficiencies' can be achieved.

The **eight Pre-Requisite Flows of Lean** are another important concept. The colours relate to those we used in workshops. The theory is that everything related to these flows required by an activity must be in place before it can be completed as promised. This is essentially the DR.PAMPPSS make-ready planning process we discuss in more detail on p. 33.

The 8 Flows are:

- Information
- Equipment
- Materials
- People/Workers
- Prior Activity
- Safe Space
- External Conditions
- Shared Understanding

There are several **customers in Lean**. The first is **society** and the world we create the built environment for. The second is the **client** who pays for the work. The third and most important customer is the **'next' customer**. This is the person, discipline or trade who receives work from a Value Creator. To create and maintain reliable workflow **Value Creators** will always have what they need in relation to the 8 Flows.

The concept of **reliability** fundamentally means we will always do what we say we will do (aka reliable promising on p. 36) at the time we promised it. However, robust make-ready planning is required before we can make a reliable promise. Although it sounds counterintuitive, being early is not always value adding as the next customer (who could be the client) may not have their own resources such as people, insurances, tenants etc. ready to take it. Types of waste are important to understand but we will return to these on p. 39.

Scan the QR code to review a video on Flow.

Developing our Supplier Network

Many of our Value Creators were within our diverse Supplier Network of 100+ Partners. We recognised our role developing their Lean competency, so we dedicated one of our 16 strategic 'How's' (initiatives) to engage with and support our suppliers with Lean deployment. This involved facilitating dedicated online and in person events in partnership with the Supply Chain School and our own central Supplier Network Team. The events included:

- **Two-hour 'Introduction to Lean'** using some examples from the Alliance.
- **Three-hour project 'Lean launch'** to create a shared understanding of basic Lean principles and concepts.
- **Six-hour 'Introduction to Lean and the Last Planner® System'** where we used the Villego® simulation as the primary learning medium.
- **Four-hour 'Introduction to direct work observations (DWO)'** using Stickle Bricks followed up by coaching of DWO's on site with some of the participants to embed the learning and deploy other strategic 'How's'.
- **Three dedicated conferences to engage with our Supplier Network** on our Six Outcomes, capture their concerns and ideas, and introduce various Lean concepts through simulations, presentations and breakout discussions.
- **Funding six places on our ISO 18404 Lean Practitioner course** – three opportunities were realised, three withdrew prior to commencement.
- Always maintaining an **open-door support policy**.

Introduction to direct work observations with Stickle Bricks, September 2023.

Introduction to Lean and the Last Planner® System with Villego, January 2023.

> The Villego event was one of the most informative and enjoyable events I've been to for a long time."
>
> **Matthew Felce, Supplier SRL Systems Technical and Product Manager**

> The Alliance have truly raised the bar when it comes to Lean. It has been embedded in everything that we do and has made us question the way we deliver, pushing us to find better ways of working and reducing our waste. Our Supplier Network have benefited from the workshops we have held and have always provided exceptional feedback."
>
> **Rhian King, SMP Alliance Supplier Network Liaison Lead**

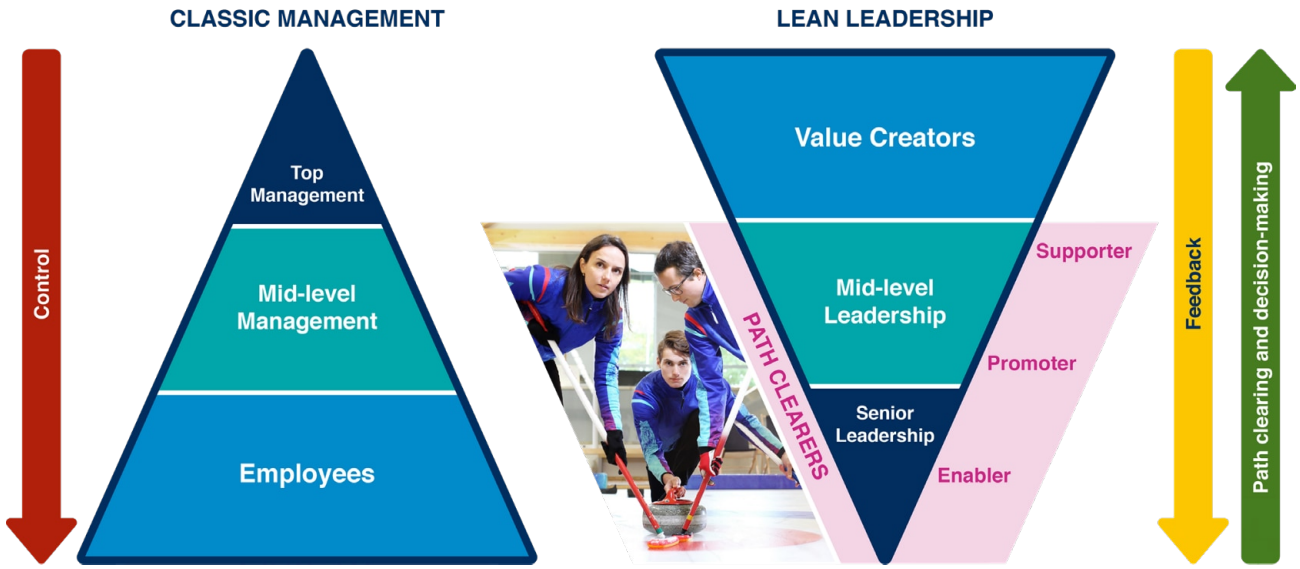
Developing our Value Creators

We have borrowed the concept of Value Creators with pride from colleagues in Finland whom we've had reciprocal knowledge sharing visits with. It turns 'classical' command and control management on its head by turning management into 'Path Clearers'. Their role is much less about saying what needs to be done, and who needs to be where, to enabling the Value Creators with all off their eight Flow needs.

In the Lean Leadership pyramid senior and mid-level leadership conduct the support activities alluded to on p. 21. Value adding reliable workflow is enabled by the Path Clearers removing threats, assumptions and constraints. This is done by constant feedback typically through visual management, collaborative planning practices, and data collection and analysis.

This does not diminish the importance of management because without path clearing activities the value adding work (and flow) is interrupted and waste created!

The images are of Central Reservation Barrier teams (precast and slipform) prior to and during a direct work observation (DWO). Using 'Build a Highway' – developed by Steve Ward – with Stickle Bricks and paper aeroplane simulations we introduced basic concepts around the five Lean principles, standardisation and learning from others. This helped build relationships with the Value Creators before conducting DWOs (p. 38 & 39).



Graphic after Kalasatamasta Pasilaan Tramway Alliance Team, Helsinki, Finland, originally developed by Jyrki Perttunen but modified by the IPT2 Programme.

DHS M40/M42 Value Creators and Stickle Bricks.

DHS M4/M5 Value Creators and paper aeroplanes.

DHS M4/M5 Value Creators and slipforming.

Section 2

Embedding learning by excelling at Lean tools and techniques

Lean tools and techniques used to embed learning

While Lean tools and techniques are relatively easy to use, the hardest part of Lean deployment is gaining buy-in and participation from the organisation's leadership (p. 6).

In this section we discuss some of the tools and techniques we used across the Alliance including Choosing By Advantages, visual workplace organisation, Six Thinking Hats, collaborative risk management & planning including Flow Walks, pull planning, made-ready planning and direct work observations.

In Lean, problems are treasures waiting for countermeasures. Among the many structured problem-solving tools available, we used fishbones for root cause analysis; 3Cs (Concerns, Causes, Countermeasures) for action planning; and 5 Whys analysis for ideation on potential and actual root causes.

Whilst we love Lean thinking, Lean doing is even better! The best way to learn about Lean tools and techniques is to read a little and use them. Being curious to learn is one of the most important attributes of a Lean Practitioner. There are more links to tools and techniques in this Playbook, and we encourage you to keep learning, as the more you find out about Lean the more you realise there is to learn!

NEAR programme teams during various workshops.

Creative thinking

The ISO 18404 standard requires the use of creative thinking in some form or the other; we successfully used de-Bono's **Six Hats** to help solve several complex problems. The basic premise of Six Hats is to keep teams in a particular thinking mode before moving onto another. There is lots of guidance available, but in short, the different hats are used in turn. We added the purple hat for 'customer' as a seventh Hat!

Facilitator
The Blue Hat (facilitator) provides the structure and direction of the workshop and helps summarise and ensure commitments are made.

Facts
The White Hat gathers facts about what is known or needs to be known.

Feelings
The Red Hat teases out how people feel about the question.

Ideas
The Green Hat identifies any creative ideas.

Optimism and benefits
The Yellow Hat builds on key ideas or highlights any expected benefits to explore more.

Devil's advocate
The Black Hat identifies what could go wrong.

Customer
The Alliance introduced the Purple Hat (+1) to bring next (internal) and external (client and society) customer requirements into the conversation.

Five tips to facilitate a creative thinking workshop

1. Identify the scope of the workshop and the problem to be resolved with the team using a 'How' or 'What' question e.g., How can we start on site sooner?
2. Identify who will wear the blue 'facilitator' hat to ensure topic alignment.
3. Whilst in every hat and using a Sharpie, ask everyone to write a maximum of three Post-its in silence. Write in block capitals, one idea per Post-it.
4. Ask for permission to keep everyone in the same hat and then ask one person up to the wall to share their top thought and explain this. Ask the group to add any similar thoughts one by one.
5. Finally, the group should agree a clear action plan using SMART commitments, with single owners. The group should agree how these will be followed up.

NEAR Start On Site Quicker creative thinking workshop, March 2023.

NEAR Mobilising Safety workshop, January 2024.

Some examples of creative thinking

In the Alliance creative thinking was used on many occasions for both online and in-person workshops.

Below are just some examples:

Ideating what innovative ideas could be funded.

Reviewing our Lean Strategy to capture any additional ideas.

Fleshing out options how to get to site quicker whilst designing in parallel.

Identifying how the Alliance production lifecycle could capture defects quicker.

Identifying how to mobilise 12 sites safely, effectively and efficiently, but quickly.

Reviewing proposed change to Traffic Management Booking System.

Exploring opportunities to improve material logistics across a programme.

Identifying how to conduct internal audits more efficiently.

Searching for opportunities to improve the site permitting process.

Exploring how to capture and measure right-first-time quality.

How to leave a Lean legacy for other individuals, teams, organisations and alliances to learn from which led us to creating this Playbook!

Lean Production Steering Committee Lean legacy workshop, February 2024.

NEAR North Traffic Management booking system review and material logistics workshops, March 2024.

Visual management

Provoking a reaction relates to the actions taken to celebrate success, or resolve an emergent risk. Visual management covers multiple concepts, which we called visual workplace organisation, and include:

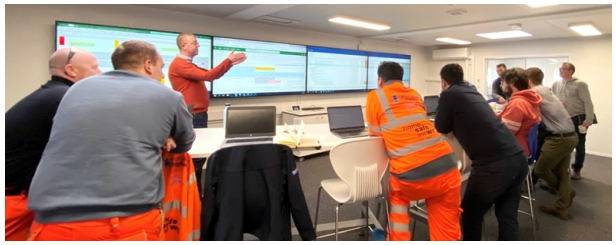
- **Visual displays** using both analogue (e.g., paper; whiteboards; magnets) and/or digital tools (e.g., Mural/Miro boards; Excel; Power BI and other software applications such as Visilean, Site Assist, BIM 360, or in-house developed applications etc.) to create a shared understanding of the current state e.g., like a newsroom that highlights:
  - Bad news early as good news!
  - Problems as treasures!
  - The ethos that 'No problems are a problem!'
- **Visual controls** such as white lining site compounds, the use of different coloured cones for safety management, and kanban 'pull systems' in lock-ups to trigger PPE replenishment, the variable speed limits and 'red X' for traffic management on motorways or adding photos to a submissions chart to add some fun to a task.
- **Workplace organisation** which includes concepts such as 5S (Sort, Set in Order, Shine, Standardise, Sustain), shadow boards for locating tools, digital key boxes for key management, or the layout of a project office to facilitate better conversations between team members.

NEAR M25 J5-7 and M20 J3-5 three-week magnet board.

ALR M6 J21a-26 schematic magnet planning.

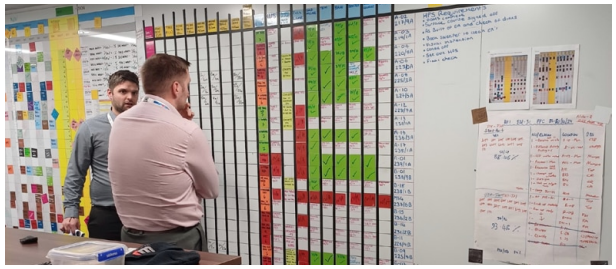
DHS M6 J4a-10 digital key management system versus keys originally in a biscuit tin.

> "Good visual management needs no interpretation and provokes a reaction."
>
> **Steve Ward**



ALR M3 J9-14 digital planning room and board.

DHS M40 J4-7 issues resolution board.



NEAR North OFT (Open for Traffic) countdown, September 2024.

Visual workplace organisation

Tips for success

- **Use wisdom before money and do it now without delay:** Paper and Post-its are cheap and quick for basic visual displays and controls. Technology helps but try not learn two things at once. Master the basics before digital.
- **Location and space planning:** Determine the ideal room location as close to the 'Path Clearers' as possible, 8m x 6m in size (ideally), high tables with no chairs ensuring adequate space and dimensions for all necessary boards.
- Establish **standardised boards** such as:
  - **Project information board:** for essential details including team successes, layout/location plans, permits or key submittals, health and safety information.
  - **Lean implementation board:** to highlight ongoing Lean activities, workplace organisation or direct work observations initiatives, problem-solving sessions, and measurable benefits and efficiencies.
- **Ownership and maintenance:** Seek designated board owners responsible for ensuring all information is the latest – like a news app on your phone.
- **Facilitation of sessions:** Nominate facilitator(s) to lead discussions to ensure productive sessions focused on the boards' content. Co-create and follow some guidelines for keeping sessions on track (p. 42).
- **Frequency of sessions:** Define the frequency of reporting sessions (e.g., daily, weekly, bi-weekly, monthly) to keep the team aligned and engaged.
- **Auditing and knowledge sharing:** Conduct regular audits of all displays, controls and workplace organisation. If you host a knowledge share with another organisation or team, ask them for +/Δ feedback on the visuals.

NEAR M1 J28-30 weekly collaborative planning in the visual room.

NEAR M1 J16-19 workplace organisation and visual boards for spare parts.

NEAR M1 J16-19 visual information board at site.

Blue cones for overhead services hazard warning.

DHS M42 J4-7 visual performance centre.

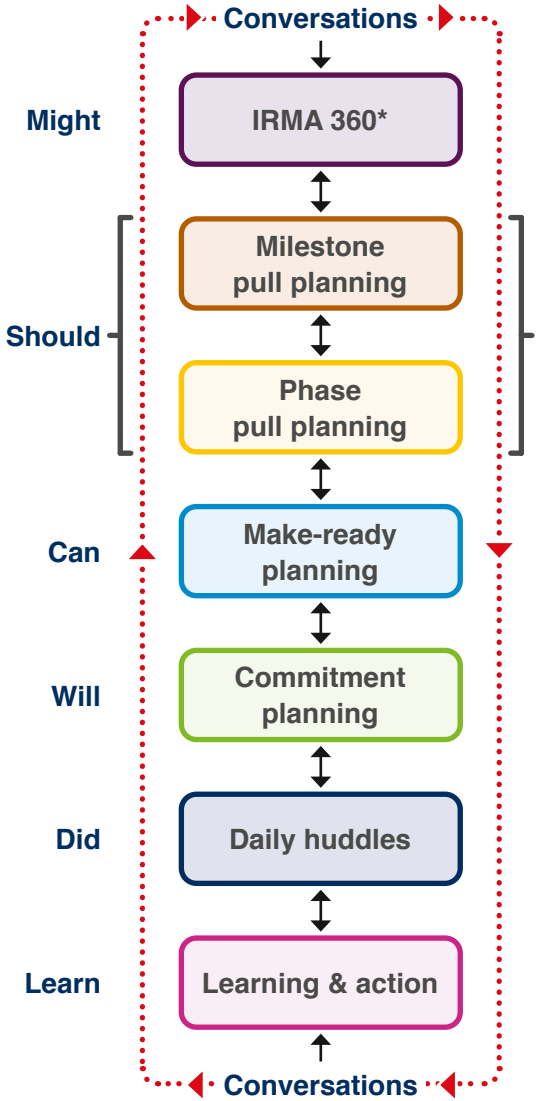
DHS M1 J10-13 digital planning room.

Collaborative risk management & planning

Collaborative planning in the UK on public sector projects has been championed by National Highways since 2009. It was originally known as the Last Planner® System (LPS), following some action-research by Professors Glenn Ballard and Greg Howell in the early 1990s. They gifted the LPS to the Lean Construction Institute who trademarked it to protect how it is used and taught, not to stop people using it. National Highways created a bespoke version which the Alliance used to gauge compliance.

There is a constant stream of LPS related research emerging from within the IGLC community that ranges from hard tools to soft skills and processes. The availability of digital LPS tools, like Visilean and V-Planner, and case studies reporting softer skills like language action, moods for learning and Lean behaviours is increasing. For example, IRMA 360 (Integrated Risk Management Approach) is PhD action-research that was used and developed further in the Alliance. It advances LPS by introducing more approaches to collaboratively identify and deal with risks (threats and opportunities) and improve the inputs and outputs of the Should, Can, Will, Did, and Learn LPS functions.

Scan the QR code to view a video on planning.



Actions

Taking a collaborative approach to risk management and leveraging the experience of the people who understand the work and risks best.

With knowledge of risks use pull planning to identify the sequence of what should be done.

Screen every task for constraints and known pre-requisites using either the 8 Flows (p. 21) or a variation such as DR.PAMPPSS** (p. 33).

Only pull tasks into the plan when all pre-requisites are in place and a reliable promise can be made.

Conduct daily huddles for commitment status, identify any constraints and escalate support requests.

Look for trends, by analysing reasons for missed commitments, and use the data for structured problem solving. Conduct a direct work observation to see what is really happening.

Last Planner® System of Production Control with IRMA 360.

* Integrated Risk Management Approach.
** Design; Resources; Procurement; Access; Materials; Plant; Permits; Shared Understanding; Safety.

Might: Collaborative risk management

In IRMA 360, the 8 Flows trigger conversations about what 'might' happen or be possible during the Steps 1-5 of the Flow Walk using divergent thinking during Steps 1-2 to identify 'risks', and convergent thinking during Steps 3-5 to prioritise 'risks' and develop IRMA 360 (risk) categories.

The 8 Flows are also important triggers for learning and action within the other LPS functions and the Flow Walk outputs inform the development of collaborative milestone, phase, and make-ready plans. The images show two teams during various IRMA 360 steps.

ALR M6 J21a-26 mid-assembly Flow Walk (Step 2: Validate).

NEAR pre-assembly Flow Walk (Step 3: Prioritise).

The Flow Walk process generates lots of data which can at first appear overwhelming, however, the prioritised output from Step 3 can be rationalised and actioned quickly using a simple Boston Matrix like the image below.

NEAR team scoring prioritised opportunities, March 2022 (see tip 5 below).

Five tips to conduct a Flow Walk

1. Identify the scope of the workshop i.e., is it a whole project, a phase such as pre-construction, mobilisation, construction or handover.
2. Use the 8 Flows to craft the survey questions e.g., with regard to INFORMATION, what might stop or disrupt handover?
3. Issue a survey three weeks before the workshop, thematically analyse the data and print out. Alternatively, you could use flip charts and Post-its and get people to do some creative thinking around each flow.
4. Prioritise the biggest opportunities and threats using blue and red dots.
5. Use Boston Matrices (aligned to risk management scoring criteria) to score the risks and then develop the appropriate countermeasures using the 3Cs technique (p. 41).

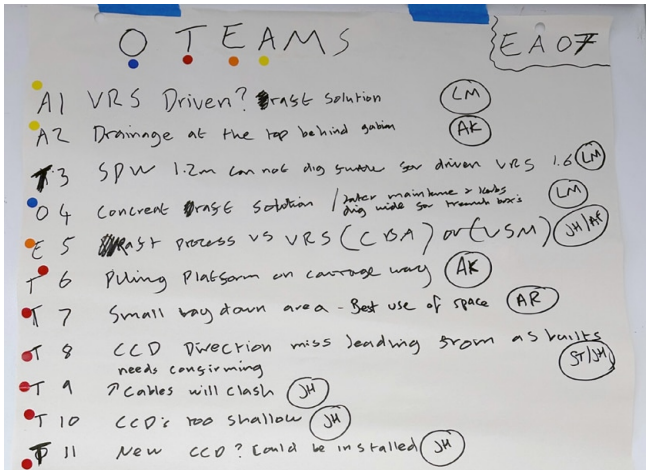
Should: Milestone and phase pull planning

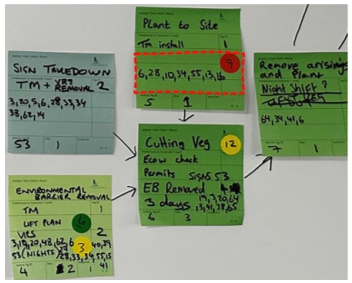
Pull planning helps flush out the right sequence of milestones and activities, identifies risks and creates shared understanding, before more detailed weekly plans are generated. Generally, the closer you get to the work, the more detailed plans become. The colours in the images represent different design disciplines, trades or stakeholders. SMP Alliance captured risks under an acronym called **OTEAMS**: **O**pportunities; **T**hreats; **E**lmo items; **A**ssumptions; **M**ake-ready items; **S**upport requests during pull planning.

Five tips to conduct a pull plan

1. Identify the workshop scope and the Last Planners required e.g., high-level milestone plan (3-18 months) or an 8-12 week phase plan between two linear chainage points on a road.
2. Starting from the last milestone, have each Last Planner identify their critical tasks and what they need in place to complete each task.
3. Each Last Planner must write and move their Post-its (physical or virtual), for shared understanding and ownership of the plan – people don't do other people's work so they must not plan it either!
4. Pull back from the end to ensure all predecessors are identified and then push forward from the start to ensure the logic is correct.
5. Map the OTEAMS captured to the milestones or activities that they need to be resolved by.

NEAR team milestone pull planning a design phase (see tip 1).





Two Alliance teams pull planning construction phases and mapping OTEAMS to the plan (see tip 5).

Can: Tasks Made Ready (TMR) planning

TMR planning is at the heart of creating flow, because without implicitly or explicitly ensuring everything is in place for each activity, completing as promised becomes a flip of a coin. If promised activities are not made ready, they:

- cannot start as planned;
- cannot finish as planned; or
- make-do by either improvising or installing a workaround.

Make-ready theory is not hard to understand or implement but we have learned it can be very difficult to practice and sustain for various reasons.

> Making-do as a waste refers to a situation where a task is started without all make-ready needs."
>
> **Professor Lauri Koskela**

Make-ready planning was one of our strategic initiatives (How's). Emergent data from four Flow Walks had many make-ready items alongside threats, opportunities and assumptions. However, to get buy-in to make-ready we also conducted a workshop and survey (n=36) to identify typical design and construction phase make-ready needs. See appendices for more information.

For both the workshop and the survey we triggered the responses by asking the same question but from each of the 8 Flows perspective (p. 21 & 31). For example, the questions were:

From a Blackhat (Supervisor)/Design Lead perspective what typically stops tasks from happening as planned with regards to information?

The same question repeated with the other flows.

We created bespoke make-ready checklists for design and construction with the outputs using the DR.PAMPPSS acronym. The DR.PAMPPSS colours below map to the 8 Flows on p. 21.

Assembly Make Ready Codes (N=68)

	D	R.	P	A	M	P	P	S	S
	Design	Resources	Procurement	Access	Materials	Plant	Permits	Shared Understanding	Safety
Monthly	1 TQs Outstanding	5 Personnel/ Resources req'd TBC	62 Procurement Req's not in Place	6 TM Req'd	8 MARs TBA	10 Plant Deliveries TBC	13 Enviro & Ecology	16 Site Visit not Conducted	14 RAMS not Approved
	2 RFIs Outstanding	64 Inductions req'd		7 Roadspace no Secured	9 Materials not on Site	11 CCTV Req's TBC	63 Permit to Dig	17 Area Team req's / OD maintenance interface req's not Clear	15 TW req's not Approved
	3 ITPs not in Place					12 Preventative Maintenance Schedule TBC	65 Quality Plan	18 Stakeholder Engagement not Complete	60 Width of safe working area insufficient
	4 Survey Info Req'd						66 Permit to Load	59 Contract not in Place	
	68 Works Examiner Inspection not scheduled						67 Overhead Permit	61 Lessons Learned to be pulled from another team	

DRAMPPS was the original acronym developed by Richard O'Connor but like every other good Lean tool, we borrowed this with pride and adapted it to our own needs.

Scan the QR code (left) to learn more about our make-ready journey through a 2024 IGLC paper and the references at the end of it.

Scan the QR code (right) for a 'Let's talk about Lean' video about our approach to make-ready planning.

> Screen every task for constraints and pre-requisites and only pull into production what is ready to be promised."
>
> **Professor Glenn Ballard**

Can: Physical and virtual rehearsals

We conducted rehearsals in the compound, off the live network. These helped create a shared understanding of the assembly sequence, any risks (threats, opportunities, assumptions and make-ready items), what worked/did not work, and any key lessons to incorporate into delivery.

On our M40/M42 project we conducted a rehearsal with our supply partners using a new precast product to give us confidence of meeting a tight programme. Higher capacity plant, alongside quality and safety (ergonomics, less dust, less people/plant interface) improvements in automated drilling were key opportunities realised. The next page has more detail how we delivered this project three months early!

We conducted another physical rehearsal on our M6 J21a-26 project prior to installing another new product (concrete crib wall (p. 38, 39 & 48). Revised installation methodology, concrete mix for workability, pre-fabrication of mesh, and machine control were key opportunities realised to improve productivity by 35% and reduce cost by £284k.

In general, other aids we used for rehearsals prior to and during pull and make-ready planning sessions were:

- Dedicated visual performance centres for workshops.
- Using weekly Go-Pro drive throughs to capture the latest situation to help teams plan and make-ready using the latest data. Google Maps was used where Go-Pro was unavailable.
- BIM was used in parallel to pull planning and make-ready to help identify all pre-requisite flows.
- Direct work observations (p. 38 & 39) complemented the rehearsals to observe the value stream and capture actual data to improve the installation and learn for the next projects.

Precast barrier installation, drilling and pinning trial in DHS M40/M42 compound, May 2022.

ALR M6 J21a-26 (August 2022) and NEAR South (February 2024) using Google Maps, BIM and Go-Pro.

ALR M6 J21a-26 concrete crib wall trial, October 2023.

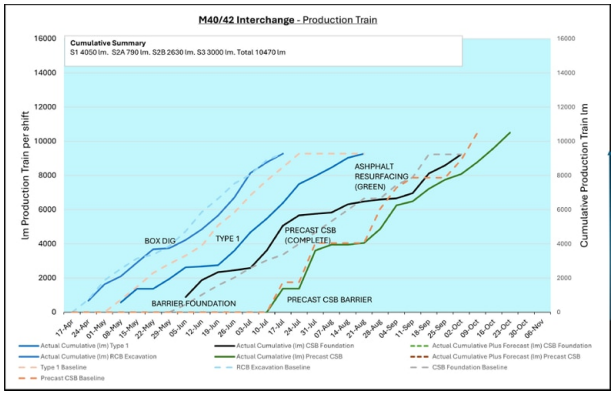
NEAR North using Google Maps and 2D Design Details prior to pull and make-ready planning, March 2023.

national highways | smp alliance

Can: Production train (Takt) planning

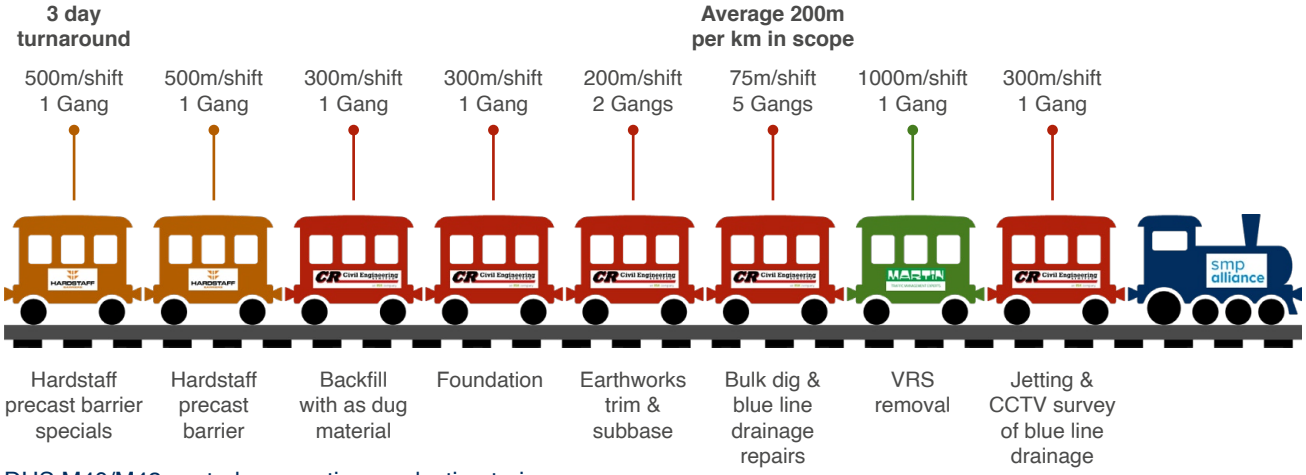
Our M40/M42 Team used many different ALPS techniques but added Takt Planning and a master sheet production rate tracker to their arsenal. Takt is the German word for 'drumbeat' and, in short, it means the production train only travels as fast as the slowest carriage. The team identified drainage as the bottleneck (slowest carriage) and increased the number of gangs by five to level out production rates.

Also, using the Line of Balance technique in the graphic, countermeasures were installed to prevent the precast foundation and barrier lines from crossing – this would have resulted in one trade having to stop whilst the other got ahead.



DHS M40/M42 central reservation Line of Balance, October 2023.

The master tracker was updated at the end of every day and night shift with daily production rates calculated. This meant the team could plan based on known rates and pre-empt where bottlenecks and risks would emerge.



DHS M40/M42 central reservation production train.

Chainage	Marker Post	Typical Detail	Make up	RCB Excavation		RCB Lower Foundation		RCB Upper Foundation	
				Type	Date	Type	Date	Type	Date
16360		Type E	Soft	Box Dig	3/20/2024	Sub-base	4/9/2024		
16370		Type E	Soft	Box Dig	3/20/2024	Sub-base			
16380		Type E	Soft						
16390		Type E	Soft						
16400	26/3	Type E	Soft						
16410		Type E	Soft						
16420		Type E	Soft						
		Totals:	2960	3200	96.25%	2990	30.43%	1100	18.59%

DHS M40/M42 master tracker.

The Team improved this approach further on our M42 J4-7 project which was delivered two months early!

Takt time:

Available work hours/demand:
2088 hrs/11,000m
= 0.19 hrs per m

Required output: 5.3m per hour

1. **Engine:** Represents understanding customer values, setting the project's direction.
2. **Carriages:** Symbolise different activities necessary for project delivery, mapped out through collaborative planning.
3. **Train Speed:** Reflects the consistent pace of activities, optimised by leveraging lessons and baseline data.
4. **Links:** Ensure a smooth flow of activities through collaborative planning.
5. **Entire Train:** Embodies continuous improvement (e.g. improving workflow).

The initiative has significantly improved productivity, exemplified by the M1 J10-13 and M1/M62 schemes, where barrier removal increased from 400m to over 1,100m per shift.

Will: Making weekly commitments

In the Alliance various approaches were used to facilitate weekly production meetings where the team captured PPC (Percentage of Promises Completed), reasons for non-completion (missed commitments) and made promises for the following week. Various online and in-person methods were used by different facilitators of the weekly meeting but, in short, the agenda and image to the right provide a flavour of how the weekly commitment meetings were run.

Click on the icons for guidance on how to make reliable promises and use 'next' customer thinking which in turns help create reliable workflow.

The following four rules for reliable promising have been adapted from a number of books and IGLC papers:

1. Understand your next customer's Conditions of Satisfaction.
2. Ensure sufficient competency and skills are available.
3. Ensure sufficient resources and capacity are available – refuse 'last minute requests' that are not planned in, sometimes you need to break the system to fix it!
4. Raise your hand as soon as a commitment is missed and accept responsibility for re-planning.

SVD team weekly production control meeting, August 2024.

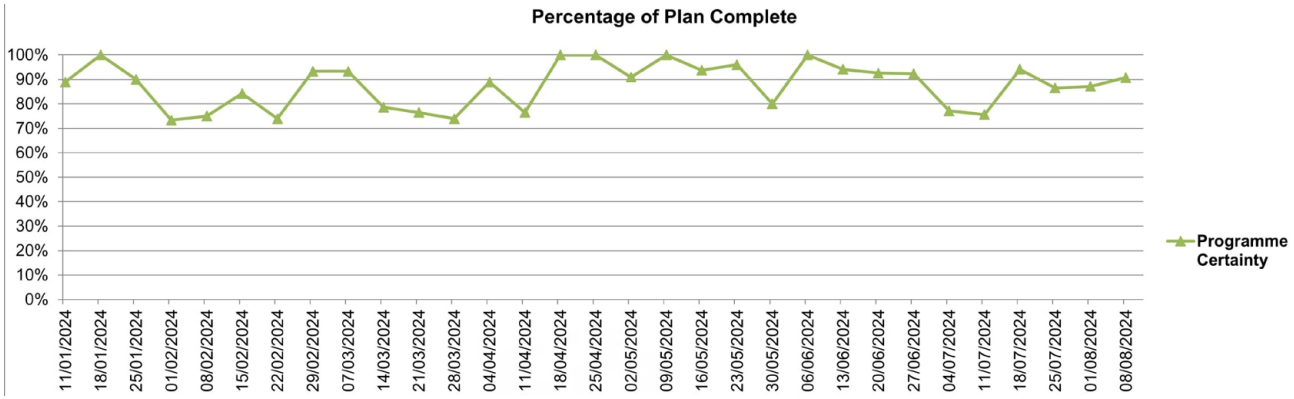
No	Function	Description	Duration
1	Look back	Mark 'done, done' promises from previous week and move to PPC chart.	5 mins
2	Look back	Review tickets 'missed' from previous week and move to 'Concern' area of PPC chart. Assign to one of the reasons for non-completion. Duplicate promises and agree new promise dates.	15 mins
3	Look ahead high level	Walk through high level milestones for next 12 weeks.	5 mins
4	Look ahead 1 week	Walk through promises for next week.	15 mins
5	Look ahead 1 week	Agree top priorities for next week and assign yellow stars.	5 mins
6	Reflection	Calculate PPC = Number of tickets done, done/total number of tickets x100. Play back reasons for non-completion.	2 mins
7	Clean up	Celebrate successes of the week (pluses/do again).	3 mins
8	Clean up	Capture any areas for improvement (deltas/do better).	2 mins
9	Clean up	Any other business.	5 mins
		Total	**57 mins**

An example of a weekly commitment planning agenda.

Did: Capturing PPC and reasons for delay

Professors Glenn Ballard and Greg Howell added ‘can’ and ‘will’ to production control. Their early research found that on average 54% of ‘promises’ made on a weekly basis were achieved. Therefore, the odds of completing promises as planned were as reliable as a flip of a coin. If you are new to capturing PPC you will find this is a normal range when you first start to track it. In design this is normally around 40%.

The primary purpose of PPC is to measure workflow reliability, i.e., did we do what we said we were going to do. The secondary purpose is as a source of data for learning and action. PPC is generally known as Percentage of Promises/ Plan Complete but is often confused with earned value unless you have a deeper understanding of PPC. It is a binary measure which we like to call ‘done, done’. ‘Done, done’ is when the next customer says “Thank you, that’s exactly what I need to do my work.” Measuring PPC properly means a task/promise is either ‘done, done’ or ‘not done’ – nearly done does not count.



DHS M42 J4-7 assembly phase PPC trend, August 2024.

Huddle Day	Project	Discipline	Check-in	Commitment status	Reason for delay	Recovery action - if delayed	2 Day priority Aphex commitments	Concerns	Causes	Countermeasures	Leadership support requests	Leadership commitments
Monday	M1 J30-31	Technology - Mark H	✓	Delayed	Review of verge signs design against existing Technolgy not started due to sign design not being completed	Advance prep work undertaken to mitigate design	Commence Tech 3D models, subject to Highwys inputs being available	Resource availability	M1 J32-35a Gantry design work ongoing & tying up resources	No alternative resources available		
Wednesday			✓	Delayed	Review of verge signs design against existing Technolgy not started due to sign design not being completed Technology 3D modelling not commenced due to Highways inputs not being available	Advance prep work undertaken to mitigate design	Commence Tech 3D models, subject to Highways inputs being available	Resource availability	M1 J32-35a Gantry design work ongoing & tying up resources	No alternative resources available		

NEAR bi-weekly pre-assembly team huddles, September 2024.

When our teams missed promises, they captured and trended the reasons for non-completion (missed commitments) against categories set by National Highways. See p. 40 for an example of how this data was used for problem solving.

Weekly Commitment Planning (aka Production Control) meetings are when PPC is reported, reasons for delay captured, the next planning period is discussed, make ready conducted, and tasks promised. Daily or bi-weekly huddles help raise issues faster so leadership (Path Clearers) can help mitigate or remove them. There are many ways to do this but simple virtual or physical visual boards with Post-its can be one of the best ways to initially learn how, before using more advanced software.

Scan the QR code if you want to learn how to create your own bespoke categories for missed commitments (delays) using the Flow Walk technique.

Did and learn: Direct work observations

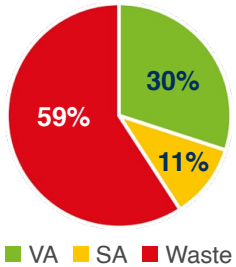
Direct work observations (DWO) were a key 'How' in our Lean Strategy. Our SMART target (and rule of thumb) was to conduct a DWO on every project once a quarter. DWOs are a fundamental Lean technique where you go to the 'Gemba' (the place where the Value Creators (p. 23) are progressing work), to observe and record what you see and hear. During these observations, it is essential to build a trust-based environment with the on-site team, so they perceive the process as a collaborative effort rather than an audit. Engaging the team is critical, as they are closest to the job and can provide invaluable insights and improvement ideas.

'Go and see' sits at the heart of the PDCA (Plan Do Check Act) CI cycle because it allows project teams to get a better understanding of activities, production rates, opportunities to remove waste and the interrelated make-ready needs, by gathering the most reliable information as soon as possible when starting a new activity. A key point is that the process is under observation, not the people. One way of easing any Value Creator concerns is to ensure it is focused on task management (i.e., Path Clearers), to ensure all make-ready needs have been provided to the Value Creators.

When conducting direct work observations, **we focus on three key work elements: value-adding (VA) activities**, **support activities (SA)**, and **waste** (p. 21). By collecting detailed data including cycle times, we can analyse the findings to identify waste and co-develop actions for improvement with the Value Creators. This process bridges the gap between planning and execution, promoting engagement, alignment, collaboration, and continuous improvement. This approach allows project teams to gain a deeper understanding of specific workflows and ensure that the make-ready planning process can be improved.

Step 1*: Identify and plan the process to study, communicate and engage with the team.

Step 2*: Conduct the study. Capture the situation on the ground as is. Review recorded data with colleagues.



Step 3*: Identify and quantify value adding, support activity and waste. Analyse and define improvements, share study outcome with the team.

* Step 1-3 examples from NEAR M1 J16-19, ALR M6 J21a-26, and DHS M4/M5.

Did and learn: Direct work observations

Once the data was analysed, we shared the findings with the project team to highlight the types of waste identified and co-created potential improvements. This step encouraged feedback, allowing the team to suggest and agree countermeasures or improvements. After implementing these, the next step evaluated their effectiveness on site. If the changes delivered the desired results, the process was standardised and applied to other areas, fostering consistency and sustainable improvement.

Six tips to conduct a DWO

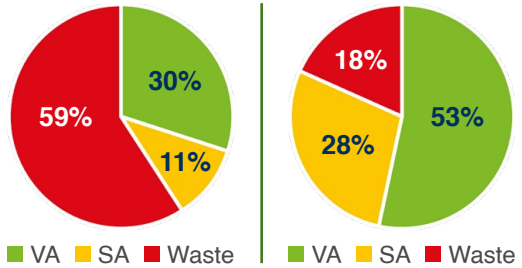
1. Identify and understand the process for study. This is a critical activity to define production rates and productivity baseline.
2. Plan the study, communicate and engage. Assemble a team, and agree what you will do, when, where, how and with whom. It is very important to engage with the construction team (the Value Creators) and teach them how to observe themselves, doing it 'with them' not 'to them'.
3. Conduct the study with the Value Creators. Capture the situation on the ground as it is. Review the recorded data with colleagues.
4. Analyse and define improvements, and identify and quantify value adding, support activity and waste. Use this information to define an improved method. Share this information with the Construction Manager and wider team, they are the best people to suggest improvements.
5. Trial and prove improvements before implementing improvements. Observe and monitor the results to refine the method.
6. Standardise the improved method. Review with process with colleagues. Are further improvements required? Develop and agree the standard operating procedure. Consider cascading to other teams doing a similar process.

Step 4: Trial and prove improvements before implementing improvements. Observe and monitor results to refine the method, and standardise the improved method, M6 J21a-26.

Scan the QR code for a 'Let's talk about Lean' video about our approach to DWOs.

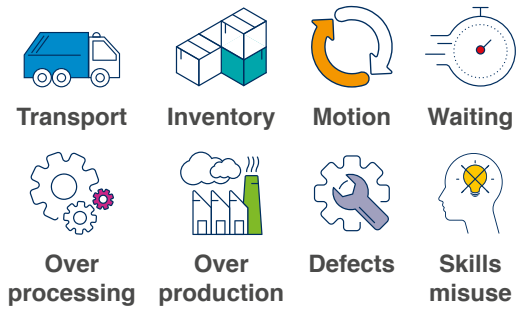
DWO description	Qty
Emergency area removal	1
Concrete infill	1
Precast barrier installation	1
Sheet piling	5
Drainage	4
Earthworks	5
Bored piling	1
Slipform barrier	1
Slipform	1
Concrete crib wall	1
Vehicle restraint system removal	1
Soil nailing	2
Total	**24**

24 DWOs conducted on live projects up to December 2024.



Activity break down – before and after implementing improvement.

Eight types of waste



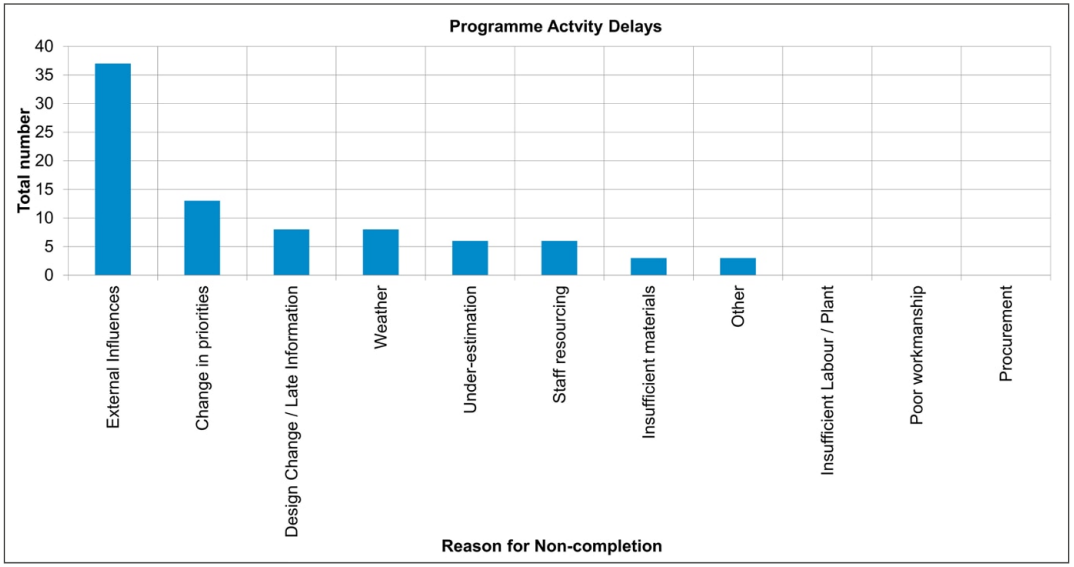
Learn: Problem solving

We captured the reasons for delays during our weekly commitment planning session for each project. This data was analysed regularly and monthly to identify recurring issues and patterns to identify the most frequent causes of delay. Based on these insights, we use structured problem-solving techniques to investigate and uncover the root causes of delays.

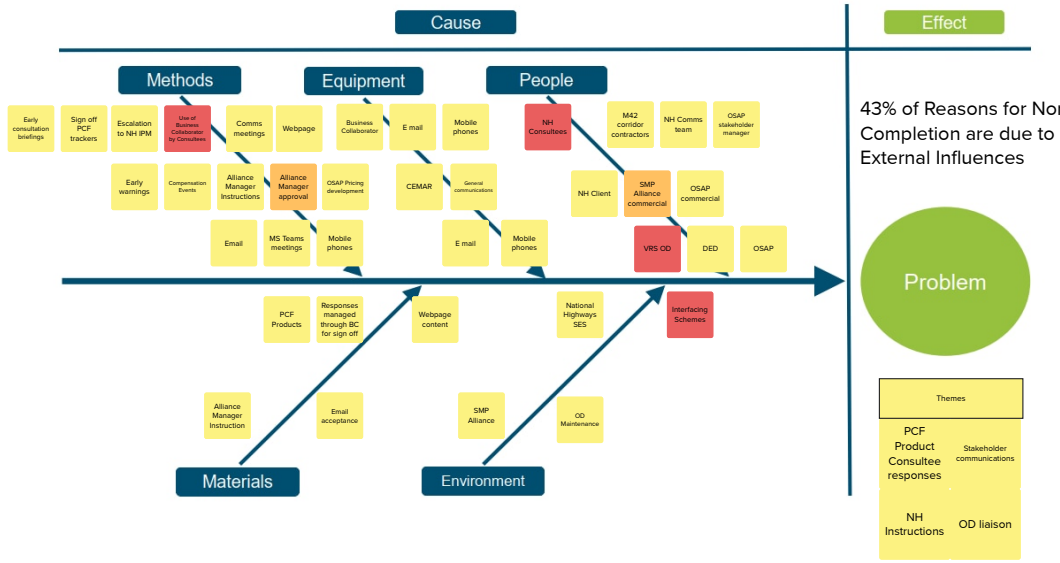
To facilitate this, we organised problem-solving workshops that not only included the project management and planning teams, but also the Value Creators who are the experts in the day-to-day operations. Value Creators have valuable first-hand knowledge of the reasons for delays and provide critical insights. By engaging Value Creators in the workshops, we gained a deeper understanding of problems and developed more effective countermeasures. We used the term countermeasures rather than solutions as there is always a better way in Lean!

Tools like the **Fishbone Diagram**, **the 3Cs** and **5 Whys** helped us investigate and resolve the problems.

DHS M1 J10a-13 Permits Fishbone Diagram, June 2024.



DHS M42 J4-7 reasons for delays.



DHS M42 J4-7 virtual cause and effect diagram, June 2024.

Learn: Fishbone Diagram and 3Cs

Fishbone Diagrams were originally developed by Kaoru Ishikawa. They helps teams systematically explore and identify potential root cause(s) that contribute to a problem (the effect), rather than just addressing symptoms. The structure resembles a fish's skeleton, with the 'head' representing the problem and the 'bones' representing different categories of potential causes.

How the Fishbone Diagram works:

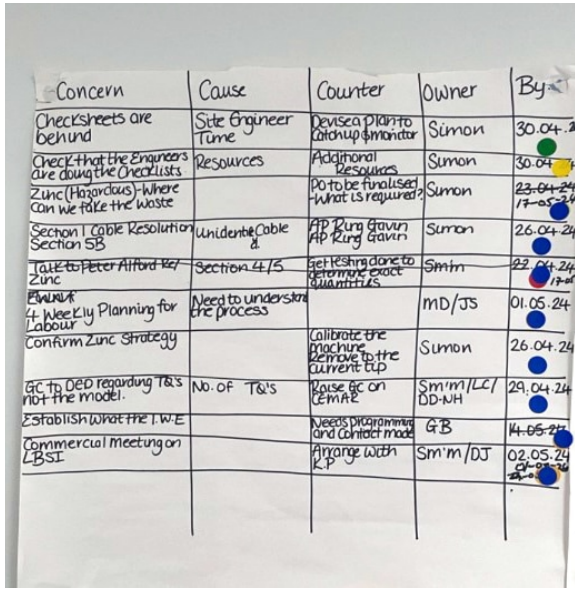
1. **Define the problem (effect):** At the head of the fish.
2. **Identify categories of causes:** Branching off from the spine, you'll create 'bones' to represent different categories of potential causes. These could be the 8 Flows or a variation of these.
3. **Brainstorm possible causes** under each category.
4. **Analyse the diagram:** Once all potential causes are identified, the diagram is analysed to determine which factors are most likely contributing to the problem. This step may involve asking 'Why?' multiple times to dig deeper into each cause until you identify the root cause.
5. **Developing countermeasures:** After identifying the root causes, the team develops and implements countermeasures to address those specific issues, ultimately solving the problem and preventing it from recurring.

The 3Cs. This framework breaks down the problem-solving process into clear steps:

Step 1
Concerns: Identify the specific issues causing delays.

Step 2
Causes: Use the Fishbone Diagram and other analysis tools to determine the root causes behind these concerns.

Step 3
Countermeasures: Develop practical measures to address the causes and prevent future delays.



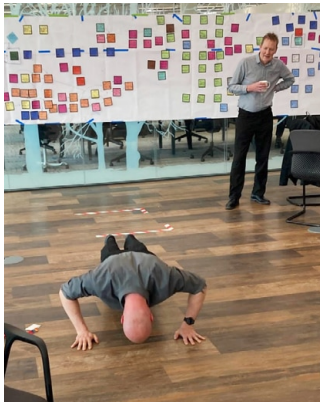
NEAR M1 J23a-25 3Cs board, May 2024.

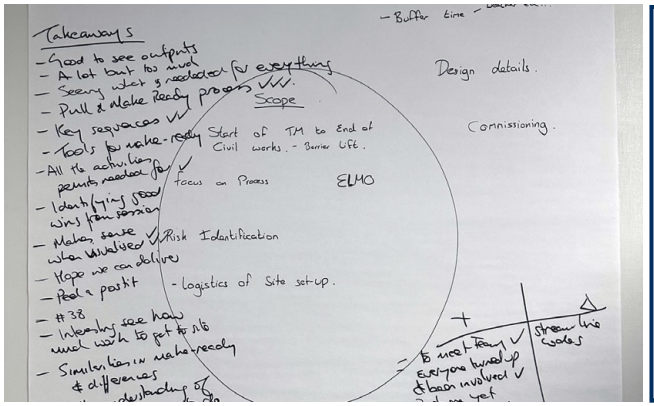
By involving Value Creators in these workshops, we not only ensure that we fully understand the reasons behind delays, but we also foster collaboration and ownership of the countermeasures, leading to more effective improvements and smoother project execution.

> "In 5 Whys problem solving don't move onto the next 'why' until you can verify by data or direct observation that the last 'why' is correct."
>
> **Steve Ward**

10 tips for efficient and effective meetings

1. Co-create your meeting guidelines/ground rules with your team through a survey or short Post-it survey; agree rules e.g. no texting, etc. Co-creation helps with buy-in!
2. For all meetings co-create an agenda with a clear purpose, inputs, outputs, and timings. Always share these agendas in advance or display them on the wall.
3. Switch cameras on for virtual meetings by default. Respect your colleagues. We don't turn up to physical meetings and stand in the corner with a bag over our head!
4. Start every meeting on time but at 5 past (e.g., 09:35) – encourage fun ground rules like 10 push-ups, sing a song or do a dance if you are late. It's fun and it works!
5. Rotate the meeting facilitator (when time is right). This builds empathy and greater team ownership and helps others gain confidence leading meetings or speaking in public!
6. For workshops co-define the scope at the start by using a circle to ask and write in what the team determines to be in (inside) and out of scope (outside).
7. Use visual management aids like Post-its or magnets to improve shared understanding between the team – this can be done with physical and virtual meetings.
8. Buy, crochet or digitise your own Elmo. Use if drifting off agenda, outside scope or spending too long on topics. Don't be afraid to wave Elmo, or with care, lob across the room.
9. Learn, learn, learn. If you run daily or weekly commitment planning meetings capture, analyse, review the reasons for missed commitments and look to improve.
10. Capture 'takeaways' and Plus/Deltas (do again/do better) for identifying good meeting/workshop practices.





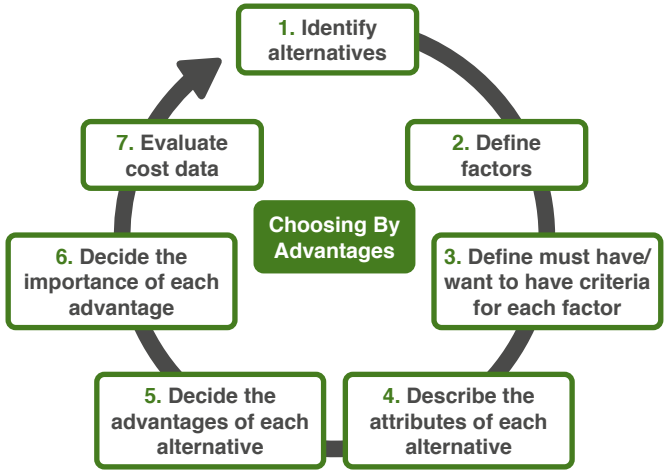
Scan the QR code to learn more about the 10-step Lean daily team huddle observation checklist.

Widespread use of Elmo

Elmo = **E**nough **L**et's **M**ove **O**n (but let's park this to come back to. **Elmo ≠ Shut Up**).

Choosing By Advantages

The Alliance successfully used Choosing By Advantages (CBA) as a collaborative process to help make considered and transparent decisions. CBA helps teams make collaborative decisions using factors, attributes, criteria, and advantages of alternatives to identify the soundest decision that minimises the likelihood of rework (over-processing waste) e.g.,changing a decision after design or construction work carried out. Cost is considered last in the process so as not to influence the early steps in decision making.



We evaluated alternatives in CBA with teams working collaboratively to identify and rank the most important factors in a decision relative to the factor with the paramount advantage. CBA uses collaboration and facilitation techniques to provide objective rationale to subjective decisions before cost is considered. CBA avoids double counting by not weighing pros against cons.

CBA may sound like a very cumbersome and technical task, but it is quite easy in practice. Like the other tools in this section and beyond, the best way to learn about CBA is to review some examples, ask for some help and/or just give it a go. Good luck!

Decisions made using Choosing By Advantages
Selected the preferred construction and traffic management sequencing.
Identified the preferred motorway verge option.
Compared central reserve precast barrier with slipform barrier methodology.
Selected the most appropriate innovation capture platform.
Recommended the best technology handover option.
Selected emergency areas that were most advantageous within project constraints.
Recommended a scope option for verge works, ‘do minimum’ or ‘do all’.

“We used CBA when conducting a risk review to select the remaining emergency areas to be produced. Several sessions were held to first identify the desirable factors, attributes, and criteria before impartially scoring against these to determine the best overall decision for the Alliance.”

Toby Bedford, NEAR Head of Production

Verge design options CBA workshop, September 2023.

Choosing By Advantages was originally developed in 1981 by Jim Suir but has now been widely adopted by the IGLC and wider Lean community since before 2009. The search function of **iglc.net** brings up 45 CBA papers if you are curious to learn more.

The QR code on the left below will take you to a YouTube video explaining CBA terms using a very simple example comparing the advantages of an apple, an orange and a banana for post-workout nutrition.

The QR code on the right will take you to a blog post, with practical examples and tips and tricks how to run CBA workshops.

Other tools and techniques used

A **storyboard** visualises the steps of an activity with photographs and narrative to clearly explain how to build an item of work. We documented the first of our Emergency Areas constructed on the DHS programme and then used these to transfer the learning to the NEAR programme. See the appendices for an example.

When topics were selected for a Lean improvement project we started the RDMAICT process using a **Quad of Aims**. This simple system is a great tool to align everyone about defining the scope, the deliverables, confirming how stakeholders will benefit and what success will look like. An example is shown below for a Direct Works Observation. If a group is not sticking to the agreed aims, Elmo is the facilitator's ally. Use him.

Aims:
- To help everyone understand Lean
- To build a sense of teamwork
- To improve performance at EA 03

What good looks like:
- Everyone engages
- Busy people want to use Lean
- Take time out of the programme

Deliverables:
- Full report of meetings etc.
- Arrangements for follow up in place
- Value Transfer Pack, this doc, learning

Stakeholders:
- National Highways
- OSAP
- DED
- Supplier Network

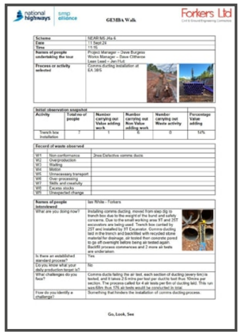
Quad of Aims (as proposed at Lean launch).

Improvement sheet.

We used **improvement sheets** as a simple one-page document to capture best practice. These A4 sheets defined what the problem, and our countermeasure was, along with photos and a summary of the benefits. We prepared 53 improvement sheets, which were easy to circulate and transfer the learning between teams.

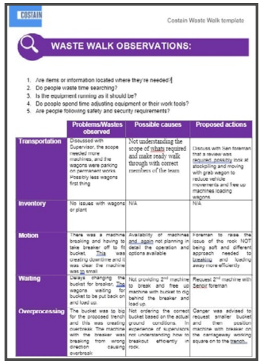
A **spaghetti diagram** is a Lean visualisation tool used to map out the flow and movement within a process. It visually represents the basic flow of people, products, and documents in a process, helping to identify inefficiencies and minimize waste. We used it to plan our M6 J4a-10 site office desk layout for optimum communication.

A **Gemba Walk** is a fundamental practice in Lean, where leaders and managers go to the 'Gemba', the place of work where value is created – to observe, engage with team members, and identify opportunities for improvement. Our Alliance leadership team participated in Gemba Walks to gain a first hand understanding of the processes, challenges, and successes on the ground. By interacting with the team, asking questions, and observing operations, leaders gathered valuable insights, promoted continuous improvement, and fostered a culture of collaboration and problem-solving. This practice is essential for driving efficiency and ensuring that improvements are based on real-world conditions and feedback.



GEMBA Walk – NEAR Midlands.

Waste Walks. Our Lean team and leadership conducted several Waste Walks on site to observe operations and identify opportunities to eliminate waste. During these walks, they specifically looked for the eight types of waste (p. 39) that impact flow resource efficiency. By directly engaging with the work environment, the team were able to spot inefficiencies, discuss potential improvements with the team, and develop strategies to reduce waste. Waste Walks were an essential part of our continuous improvement efforts, helping us to streamline processes, enhance productivity, and create a more effective and sustainable work environment.



Waste Walk observation sheet from M6.

These are a few more of the Lean tools used successfully by the Alliance, but note, lots of other tools are available.

Foreword
Introduction
Section 1: Our People
Section 2: Embedding Learning
Section 3: Best Practices
Appendices

Section 3

Sharing and embedding current best practices

Lean Communications Plan

We brought everyone in the Alliance on the Lean journey through robust communications planning and delivery, which was a key part of our Lean Strategy. This helped raise awareness, drive engagement, embed Lean theory and practices, promote collaboration and embed a culture of sustainable continuous improvement across the Alliance.

Regular updates including project deployment, lessons learned, current best practice, safety and wellbeing moments, and celebrations of individual and team successes kept colleagues engaged and informed about the positive impact of Lean.

Communications channels included monthly all-hands video calls (Touchpoints), Let's talk about webinars, news stories, social media posts, national and international events showcasing our ISO 18404 Lean journey.

Monthly online Alliance Touchpoints were led by the Alliance Managing Director or another member of the ALT (Alliance Leadership Team), plus presentations from others in SMP Alliance. The purpose of these was to share items such as: safety and wellbeing moments, general updates including new projects starting or completing, celebrating success by recognising people and teams who had supporting us achieving our Six Outcomes (p. 8).

	Monthly	Quarterly	Annually
Touchpoints	Single slide update	10 mins strategy update	
Let's talk about Lean		Current best practice share	
Digest	Strategy and/or project deployment article		
Connec7 magazine			4-page Lean 7imes bi-annually
Events	Supplier Network, 7ogether, IGLC, EGLC, National Highways Lean Practitioner, LCI		
LinkedIn	Approx bi-weekly – all of the above, e.g., 18404 kick-off, make-ready post, pull planning, training & coaching		

Lean Communications Plan.

Managing Director presenting Lean 7imes Touchpoint slide, December 2023.

Let’s talk about... Lean

There were 13 Let’s talk about Lean webinars between 2023 and 2025. The primary purpose was to help demonstrate Lean leadership and the depth and breadth of Lean deployment across the Alliance. We had 23 different presenters and over 250 attendees from right across the Alliance (which included our Supplier Network).

Let’s talk about Lean topics:

- Current best Lean practices
- IGLC 31 takeaways
- HELMA
- NEAR M1 J32-35a using TMR
- ALR M6 J21a-26 – Direct work observations
- DHS M6 J4a-10 – Lessons learned and Lean tools
- DHS M1 J10a-13 – Lessons learned
- Rou7e Lean e-learning launch
- DHS M42 J4-7– Lessons learned
- ALPS deployment
- KTPs – Knowledge Transfer Packs
- Improving handover process using collaborative planning
- ALPS Playbook launch

Let’s talk about Lean webinar, November 2024.

Scan the QR codes below for some Let’s talk about... Lean webinars

What is Lean & ISO 18404 and how we planned our ALPS

Tasks Made Ready case study

Direct work observations on concrete crib wall installation

Lessons learned from various projects across the Alliance

Knowledge Transfer Packs

ALPS Playbook

Connec7 Lean 7imes

We used our Connec7 communications channels to showcase Lean updates, key milestones, lessons learned, and messages from our Board and ALT about Lean across the Alliance.

Lean graduated to the front cover of the magazine by June 2024! Scan the QR code on the right to access this issue.

Connec7 issue 7, June 2024.

> The adoption of Lean principles is a key component of working with National Highways. It contributes and improves our safety performance and its beginning to positively impact on the quality of completed work. It is beyond doubt that this is supporting the Alliance's performance, which is leading the way in terms of productivity improvement and standardisation. The roll out of our make-ready planning is another example of our leadership commitment to improving the sector and the construction industry."
>
> **David Bray, SMP Alliance Programme Director**

Events

As we developed and deployed our Lean Strategy we were very proud to be able to share our journey both in the UK and internationally. The audiences were a mix of Lean practitioners, researchers, and consultants, as well as Alliance and industry colleagues curious to learn how Lean was deployed across SMP Alliance.

Events presented ALPS at:

- **IGLC* Canada, France, and New Zealand, 2022-2024**
- **7ogether, 2023 and 2024**
- **Finnish Government Delegation, 2023**
- **EGLC* Denmark, 2024**
- **P13 ICG*, UK**
- **LCI* Finland and Ireland, 2024**
- **NEC4* Hong Kong, 2024**
- **Rail Reform Forum, 2025**

* All acronyms can be found in the ALPS glossary.

As part of our reciprocal knowledge sharing relationship we developed with our Finnish infrastructure colleagues, National Highways commissioned an Integrated Project Delivery (IPD) benchmarking study. A short summary can be found on p. 57.

Paul Ebbs, IGLC in Lille, France, June 2023.

Simon Crisp with Finnish delegation, October 2023.

Stephen Williams, LCI Finland, June 2024.

Nour Al Hour, Annual 7ogether, June 2023.

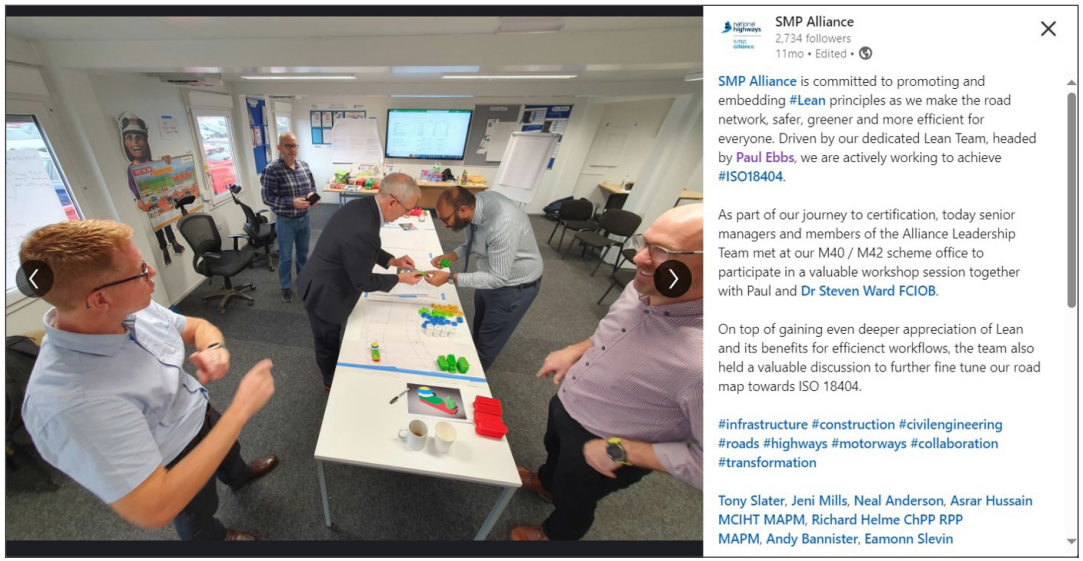
LinkedIn posts

Several LinkedIn posts were shared every month, to highlight key achievements and ongoing Lean activities within the Alliance. Various topics shared included achieving ISO 18404 certification, Lean training and coaching initiatives, engaging suppliers through workshops, showcasing current best practices through our external and internal Lean audits, project kick-offs and workshops such as creative thinking, make-ready planning, and direct work observations. We did this from both our personal and SMP Alliance LinkedIn accounts.

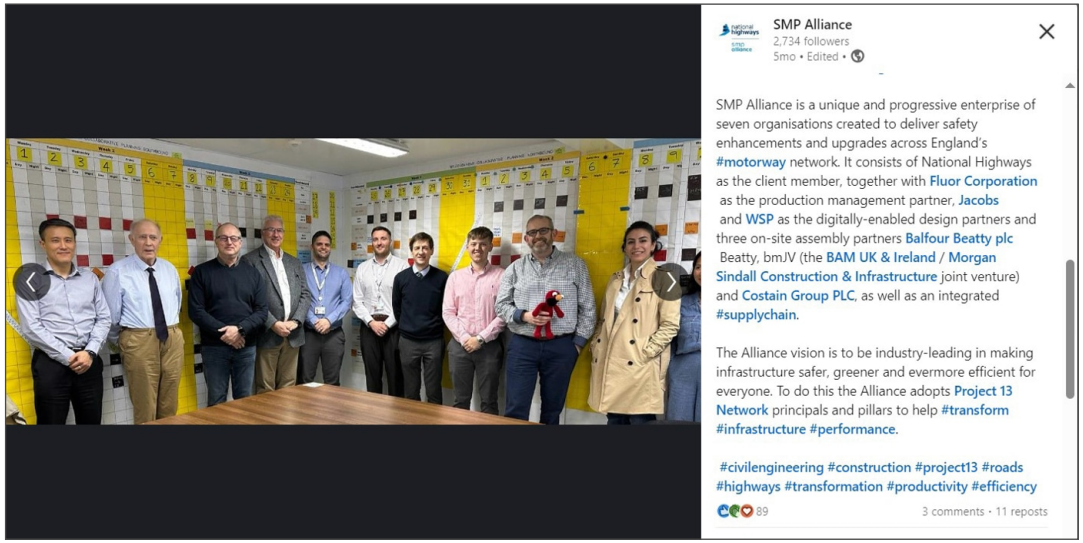
By sharing our stories, we not only celebrated our progress, but also demonstrated our commitment to Lean from the Board and Alliance Leadership Team, right across to our Value Creators. The primary purpose of using LinkedIn was to promote knowledge sharing, foster collaboration, and inspire others across the globe to adopt, implement and adapt some of the Lean practices we shared.

This supported our vision 'To be industry leading in making infrastructure safer, greener and evermore efficient for everyone', and our mission 'To be a high-performance enterprise that excels in delivering enhancements to the strategic road network'.

Scan the QR code to access the SMP Alliance LinkedIn page, or visit: **www.linkedin.com/company/smpalliance**



SMP Alliance shared a post showing leadership demonstrating a commitment to embedding Lean by participating in a workshop on our ALR M40/M42 project, September 2023.



SMP Alliance shared a post after BSI Stage 2 ISO 18404 audit at NEAR M1 J32-35a, March 2024.

ISO 18404 and ALPS audits

Demonstration of regular and effective external BSI and internal audits were required to achieve and maintain ISO 18404 certification. Our HELMA moderations and assessments (p. 9 & 53) complemented these. Following our BSI ISO 18404 Stage 2 audit in March 2024 (certified in June) we conducted internal audits on all projects to enhance Lean deployment across the Alliance and capture current best practices for this Playbook.

Our audits ensured we were doing what we said we would do in our ALPS (i.e., compliance with our ISO 18404 system) and to provide evidence for our HELMA. Additionally, we recorded 47 opportunities for improvement (OFIs). The audits also created an opportunity to engage with site leadership, discuss the progress of Lean deployment, and document any support requests to enhance our approach to continuous improvement.

After each audit, we documented the findings, including training records, areas for improvement, and key observations. These insights were then shared with the project team to foster further improvements and refine practices. This collaborative approach ensured that audit feedback enhanced ALPS performance and continuous improvement.

The images are a selection of the internal and external audits between March and June 2024.

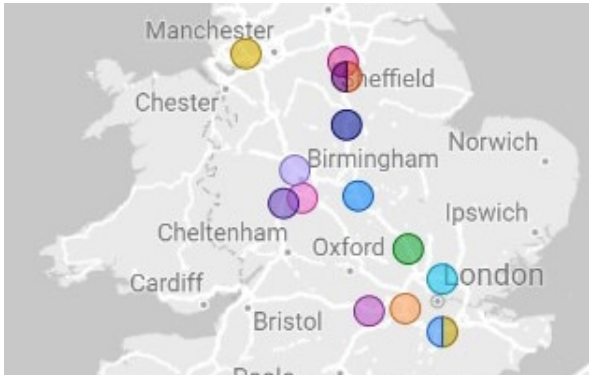
Six tips to conduct an internal Lean audit

1. Define the scope and objectives
2. Create a detailed audit plan
3. Engage and communicate
4. Gather and document evidence
5. Provide clear and actionable feedback
6. Follow-up

BSI Stage 2 ISO 18404 audit at ALR M40/M42.

NEAR M1 J23a-25.

DHS M6 J5-8.



ALPS internal audit locations.

NEAR M1 J16-19.

NEAR M1 J28-35a.

NEAR M3 J2-4a.

HELMA moderations and Lean assessments

HELMA (Highways Excellence Lean Maturity Assessment)

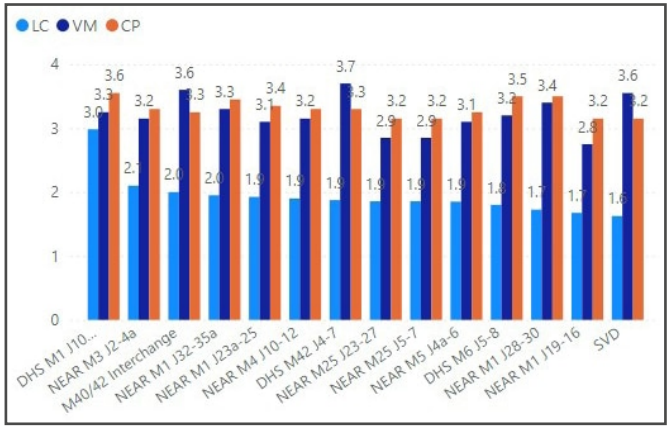
HELMA was an annual evaluation conducted by National Highways to assess the implementation and maturity of Lean practices across the SMP Alliance. Every September, moderators from National Highways conducted a full day moderation, assessing and scoring the Alliance across ten key topics as listed on p. 9. Our annual HELMA helped us identify areas of strength and opportunities for improvement in our quest to embed operational excellence and a culture of sustainable continuous improvement across the Alliance.

In preparation for the moderation, we developed a Mural board to showcase all our HELMA evidence. Typical participants on the day included the moderators (HELMA Buddy and external independent moderator), steering committee, the Alliance Leadership Team, and a wide range of Alliance colleagues showcasing various Lean initiatives.

HELMA, September 2023.

As part of our commitment to embed a culture of sustainable continuous improvement, we conducted annual assessments across all programs and schemes. These assessments, based on the National Highways framework, focused on three key areas: Collaborative planning (CP), Visual performance management (VM), and Lean culture (LC). The scoring criteria range from 0 to 4, allowing us to measure progress and identify areas for improvement.

- **Collaborative planning assessment:** identified current best practices and areas for improvement across a project. This assessment evaluated the entire CP system, by focusing on aspects such as production control, problem-solving approaches, the use of make-ready plans, and engagement.
- **Visual performance management assessment:** evaluated the effectiveness of VM tools across each project.This included assessing how key project information is displayed, communicated, and used to track progress and resolve issues to ensure transparency, clarity, and effective communication across all teams involved.
- **Lean culture assessment:** measured the extent to which Lean principles are integrated into the culture of each project. It focused on several areas, such as team leadership, engagement, and role modelling, to understand how deeply Lean thinking has been embedded into daily practices. The objective was to promote a culture where Lean principles are part of the way teams operate and deliver value.



Assessment scores for 2024.

Knowledge Transfer Packs

Knowledge Transfer Packs (KTPs) were developed using various structured methodologies such as A4 continuous improvement sheets, storyboards, and A3 RDMAICT sheets (a Lean Six Sigma approach). These approaches ensured a systematic approach to identifying, solving, and sustaining improvements, while also capturing and transferring the benefits across projects.

Below is an example RDMAICT improvement project that utilised an IRMA 360 8 Flow survey, followed by an online collaborative problem solving workshop that resulted in £443k savings.

NH Ref No. **AUTHOR: Rob Sanger** **DATE: 05/09/2022** **VERSION: 01**

TITLE: Stopped Vehicle Detection – Road space booking and Traffic management installation improvements **Headline benefits: £443k savings**

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RECOGNISE

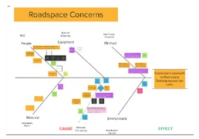
The Stopped Vehicle Detection (SVD) programme was to retrofit over 1000 SVD radars across 20 National Highways schemes. This involved liaison with 5 different Area teams to book Roadspace and then install overnight traffic management along 370 km of smart motorway.

Some areas of the Network have multiple schemes in progress and the Operational Directorate also require Roadspace to carry out maintenance works. This results in teams sometimes competing for the same Roadspace. SVD is one element of the Smart Motorway Stocktake and thus a high priority.

The team needed to first understand the reasons why Roadspace might be unavailable and also any blockers to traffic management installation.

ANALYSE

The survey data was analysed and subdivided into categories:
There were 93 concerns about Road space booking; 86 about TM access and set up; 67 concerns about key people;43 information concerns;35 specific concerns;26 plant and material concerns and 20 installation area concerns. There were a further 9 general comments from the survey.
The survey response data was transferred onto a Mural virtual whiteboard and a workshop convened with key persons. The topics were discussed at length and the constraints from the survey were used to create two cause and effect diagrams, one for Road space bookings and another for traffic management access and set up.
Actions from the workshop were logged on a 3C's board.



DEFINE

Purpose
To understand the reasons why Roadspace bookings are delayed or unavailable and also to understand the blockers to traffic management installation on site. Also, to generate improvement ideas and implement them for improved delivery

Stakeholder Benefits
SMP Alliance – SVD team – Improved certainty of Road space bookings and traffic management installations
National Highways – Delivery to programme & Stocktake actions, supporting reputation
National Highways Area Teams – improved co-ordination, communication and relationships with the Alliance

Deliverables
IRMA 360 survey
Mural virtual whiteboard for workshop and analysis
Cause and effect diagrams

Success Criteria
Improved understanding of Roadspace booking process
Improved certainty of securing Roadspace bookings
Improved understanding of blockers to traffic management installation
Improved delivery of traffic management installations
Shared traffic management systems with other parties

IMPROVE

Roadspace booking improvements:
Area 7 have a really good Roadspace booking system which we have promoted as best practice nationally. We have worked closely with the Roadspace booking team to improve accuracy for data entry. Relationships have been vastly improved creating a strong network. This has improved our ability to book Roadspace but also promoted the importance of the SVD programme. Previously we were experiencing approx. 2 booking refusals per month. Since the workshop we have not had any refusals.
Traffic management improvements:
Contingency equipment was arranged within the local site compound for quick access. We were losing 5 shifts per month due to failure of equipment/ unavailability of equipment. Since the workshop we have had no cancelled shifts due to equipment issues.
We are now providing our own Rolling Road Block using Enhanced Mobile Carriageway Closure (EMCC) on M3 that provides a 9-minute sterile area for safe installation of advanced signage and cone tapers. On M3 the ROTTMs are inoperable, HETOs are under-resourced, and Police are unavailable to assist. Hence M3 scheme could not have been delivered without EMCC.

MEASURE

An IRMA 360 survey was sent out to the SVD team to gather data about experiences of Road space booking and traffic management. The survey asked questions about what stakeholders will impact SVD access to the network and what was the biggest concern in relation to not getting access to the network (Road space and traffic management installation). The questions were shaped from different perspectives covering the topic in relation to information, equipment, material, people/workers, prior activity, external condition, safe space and shared understanding.

A total of 370 statements were collected for analysis from 19 respondents

Themes	# Comments	# Sub-themes
Stakeholders of concern	58	20
Biggest concern(s)	39	20
1. Information concerns	55	22
2. Equipment concerns	23	14
3. Materials concerns		12
4. People/Workers concerns	23	14
5. Prior activity concerns	43	19
6. External condition concerns	36	21
7. Safe space concerns	22	14
8. Shared understanding concerns	19	4

CONTROL

Roadspace booking- the improvements introduced have been monitored for the last 6 months and are proved to be sustainable as it benefits all parties
Traffic Management- EMCC is now being considered by National Highways and the Traffic Management fraternity as the standard process for installing traffic management on ALR schemes
Contingency equipment is now business as usual for SVD compound set up

TRANSFER

The lessons learned from SVD Roadspace booking and traffic management is being fed into the Alliance playbook to become the standard operating procedure.

Knowledge Transfer Pack example.

Scan the QR code for a 'Let's talk about... Lean' video highlighting some of our KTPs.

The RDMAICT steps are:

Recognise: The process begins by identifying and recognising a specific problem, challenge, or opportunity for improvement. This step involves engaging with teams and gathering initial observations.

Define: Once the problem is recognised, it is clearly defined to establish the scope and boundaries of the issue.

Measure: In this step, relevant data is collected to quantify the problem. This may involve observing processes or gathering input from stakeholders.

Analyse: Data is analysed to identify root causes, patterns, and contributing factors. Techniques like Fishbone Diagrams or 3Cs may be applied to uncover the underlying issues driving the problem.

Improve: Based on the analysis, countermeasures are developed and implemented to address the identified causes. This step focuses on practical actions that can drive measurable improvements in processes, efficiency, or outcomes.

Control: Once improvements are made, controls are put in place to sustain the gains over time. This may involve developing Standard Operating Procedures (SOPs).

Transfer: Finally, the benefits and lessons learned are captured and transferred through the development of a KTP. This ensures that improvements are documented, shared, and replicated across the organisation, promoting current best practices and embedding a culture of sustainable continuous improvement.

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Knowledge Transfer Packs

KTPs were created following various Lean activities, including process mapping, problem-solving sessions, or direct work observations. For instance, several KTPs were developed after conducting direct work observations, where teams collected valuable data and insights by observing real processes on site. The Alliance created 27 KTPs, totalling £13.7m of actual realised benefits.

Lean enabled efficiencies are efficiencies where Lean thinking or standardised approaches have been adopted plus outcomes from our Lean work study projects. Only our Lean work study projects have been captured on KTPs.

We established dedicated monthly KTP Sharing Sessions, where key insights are shared with the wider team. These sessions provide an opportunity to discuss the improvements made, the benefits achieved, and the tools used in the process.

By focusing on going to the Gemba to 'go and see', engaging directly with processes, and applying structured problem-solving, KTPs help ensure that improvements were sustainable and could be replicated across projects to maximise benefits supporting our Six Outcomes.

Programme	RDMAICT KTPs	Carbon savings tCO_2e	Actual benefits realised
ALR	Reduction in Earthworks – dynamic engineering		£112,592
ALR	Collaborative planning		£157,216
ALR	Central Reserve concrete barrier installation		£940,577
ALR	Crib wall install		£284,000
DHS	Improvement to construction of Emergency Area		£37,225
DHS	Improved management of keys		£26,789
DHS	Improving plunge piling installation		£739,430
DHS	Use of permanent formwork		£26,240
DHS	Improvements to installation of Redi Rock retaining wall		£94,504
DHS	Concrete infill – improvement		£369,000
DHS	VRS removal improvement		£5,500
DHS	Trimming process		£432,930
DHS	Goucha spray cannister		£19,900
DHS	Collaborative planning on DHS M42 J4-7		£226,298
DHS	Improvements to pinning on Hardstaff precast concrete barrier		£36,595
NEAR	CP and TMR for seven layers protection		£184,000
NEAR	Value stream mapping for drainage		£1,107,360
NEAR	Drainage Schedule Improvement (VSM)		£998,940
NEAR	Reduced CO_2 emissions using Intellitag system	62.6	N/A
NEAR	Reduction in earthworks due to shear vane testing	12.4	£154,732
NEAR	Permit improvements		£62,720
NEAR	Meetings, reporting and commercial		£100,125
SVD	Standard foundations for SVD radars		£5,063,454
SVD	Alternative posts for SVD radars		£848,447
SVD	Improvements to roadspace booking and TM installation		£443,400
SVD	Use of Mural virtual whiteboard	112.9	£752,980
SVD	Collaborative planning		£446,372
	Total	**187.936**	**£13,671,326**

ALPS monthly dashboard

The ALPS dashboard was developed to visualise, track, monitor, and trend Lean deployment performance across the Alliance. It included key metrics from various programmes and projects on a single platform, highlighting areas that required attention and support to the Alliance Leadership Team (ALT).

The primary benefit of the ALPS dashboard was that it improved transparency and visibility of ALPS deployment, offered data-driven insights to support informed decision-making, and provided a focal point for communication and collaboration across Alliance teams.

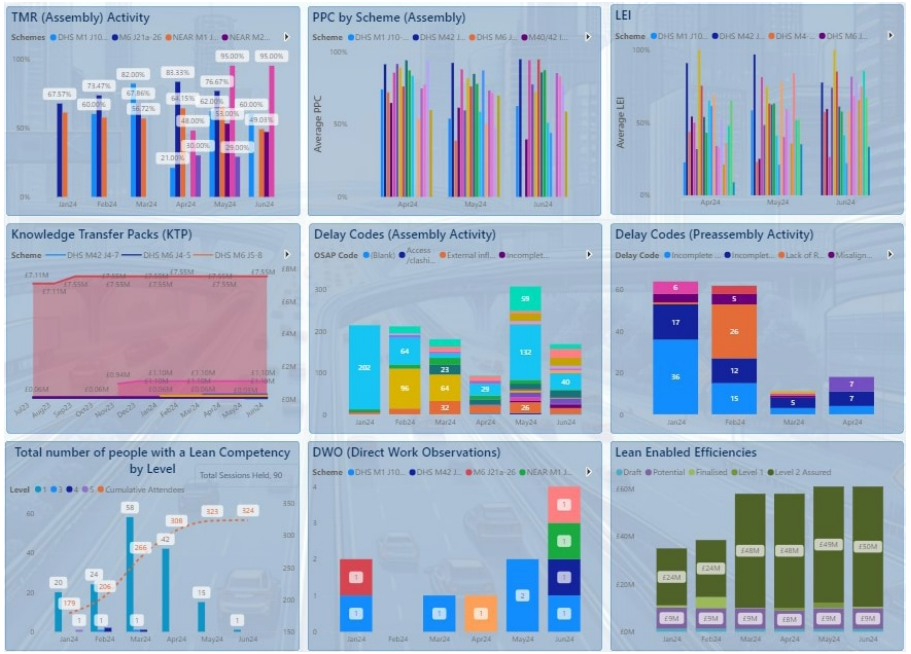
The ALPS dashboard allowed users to view data at multiple levels. At a high level, it provided an overview of the Alliance's Lean performance. From there, you could drill down to view data at the programme level and further to the project level. This enabled users to select a specific project and see all the relevant data, including metrics such as PPC, TMR, LEI, and other ALPS performance indicators such as delay trends and the latest numbers related to Lean competency, direct work observations and Lean enabled efficiencies.

The ALPS dashboard operated through a structured process:

1. **Data entry:** Each project team logged their monthly data into the system.
2. **Review and follow-up:** The steering committee reviewed the data entries for consistency and accuracy, ensuring that all metrics were kept up-to-date.
3. **Automation and visualisation:** Once the data was reviewed, it was automatically reflected in the Power BI dashboard, where it was transformed into dynamic, interactive visualizations.

The ALPS dashboard was presented each month at the PPR (Project Performance Review) to share insights and key takeaways from the previous month, highlighting successes, challenges, and areas that need attention.

The PPR also provided the ALT with an opportunity to request any specific Lean deployment support.



Screenshot of ALPS Power BI dashboard in June 2024.

Research case studies

18404 IGLC paper abstract

The literature and case studies reporting Lean Transformation in the construction/infrastructure sector are rare. This study's objective is to examine whether the Lean Standard, ISO 18404 provides a useful model for Lean Transformation. By Case Study and Participatory Action Research, the deployment of ISO 18404 and certification journey of a UK highway alliance (the Alliance) is reported, structured around four themes for Lean Transformation. Findings are supported by the latest literature along with a quantitative and qualitative survey with those involved in ISO 18404 deployment (n=35/58). The survey data was thematically analysed and is largely articulated through the four Themes for Lean Transformation. Whilst ISO 18404 is imperfect, it provides a useful model for Lean Transformation and can assist with embedding a culture of sustainable continuous improvement in an alliance.

The four themes for Lean Transformation:

1. **Organisational structure** – supportive business model required.
2. **Roadmaps and clarity of Lean concepts** – need dual clarity before the critical mass will adopt Lean.
3. **Lean leadership, culture and community of practice** – senior leadership participation required and philosophy comes before tools.
4. **Change by force and making Lean business as usual** – moving to clients specifying Lean, training and use of the principles.

Scan the QR code or visit **iglc.net/papers** to access the IGLC website to find lots more research case studies.

Make-Ready paper abstract

Project management methods like risk management (RM), production planning (including make-ready) and continuous improvement (CI), are often considered in isolation of each other. The literature recognises how teams struggle with implementing these methods according to known current best practices and standards. The purpose of this paper is to report the ongoing development of a research artefact called IRMA 360 (Integrated Risk Management Approach) through a Longitudinal Action Case Study over four cases between 2016 and 2024. There is a particular focus on Case 4 – an ISO 18404 Certified Alliance.

In summary, this research has identified links between RM, make-ready planning and CI, and proposes IRMA 360 as a model to advance the Last Planner® System (LPS) by feeding what 'might' happen or might be possible through 'should, can, will, did, learn' functions. We conclude that both effective RM and make-ready are required to create and protect value which includes reliable workflow. However, to embed RM and make-ready planning a safe and collaborative environment is desired. In theory, RM is complex as it deals with uncertainty. On the other hand, make-ready is a relatively straightforward activity to 'just' screen tasks for constraints. However, in practice both are extremely difficult to implement.

Integrated Project Delivery at National Highways

Integrated Project Delivery (IPD) is a form of procurement that fuses together project alliancing and lean thinking that delivers extraordinary performance compared to traditional methods. The goal of IPD is to create a collaborative environment, where team members benefit from driving the cost down whilst maintaining the agreed quality, scope, and programme requirements. A key differentiator of IPD is that it is client led, whose key role is to create and maintain a collaborative culture with an integrated team, during the design and production process. Prior benchmarking by TIES Living Lab identified that only 35% of National Highways projects were delivered on time and to budget in RIS1. This performance is comparable to the sector as a whole but clients that use IPD are reporting between 92% and 100%.

Lessons learned

Knowing what we know now after five years deploying Lean across the Alliance, we pulled this table together to share our lessons learned and what we will do next time to improve the outcomes from Lean deployment on our next infrastructure alliance or enterprise programme.

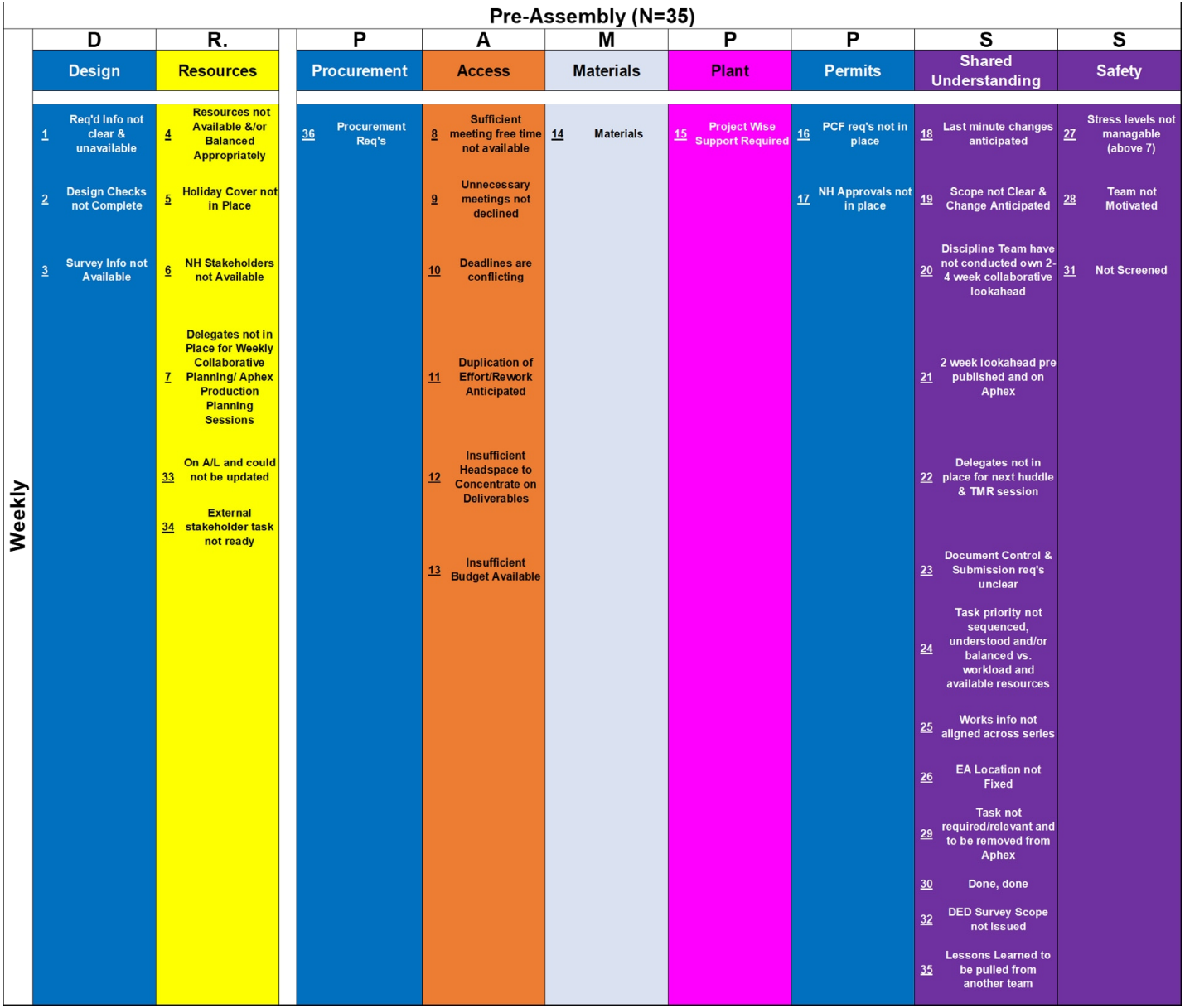
Developing our people	Embedding learning by excelling at Lean tools and techniques	Sharing and embedding current best practices
Allocate funding upfront based on a minimum ROI of 20:1. Our ROI exceeded 30:1	Develop a Level 1 Hoshin Kanri Strategy before the Level 2 Lean Strategy and Level 3 Plans. Create a specific Lean Plan/Team Charter for each project to sign up to and own.	Create and implement a Lean comms plan from the outset.
Conduct diagnostics early and identify what Lean support (internal and external) is required.	Ensure a clear line of site between vision, outcomes, mission, values to Lean deployment – ISO 18404 will assist this.	Celebrate successes even more than finding problems to resolve.
Create a common Lean language using ISO 18404 as the framework and establish a community of practice from the start.	Identify and map all value streams early and create a schedule to revisit regularly.	Conduct direct work observations at the start of every critical activity – capture, share and embed this learning on every other project.
Develop Leaders Standard Work that includes leadership engagement with the Value Creators – at the Gemba – as soon as value is being created to identify flow blockers.	Master the basics (e.g., use the full LPS, visual management, and DWOs) but get ready to introduce more advanced tools like CBA when the team is ready.	Incorporate more lessons learned into the Lean Strategy as it is deployed.
Develop and implement a skills matrix for each role which includes appropriate Lean competencies.	Provide meeting facilitation training and coaching to all team and project leaders as part of a wider skills matrix.	Make more time for sharing between Lean Coaches and project leadership to learn from each other's experiences. Establish a routine of peer-to-peer project visits.
Bring your Supplier Network along the journey from day one.	Standardise Lean deployment where possible across projects.	Borrow current best practices from others with pride.
Implement a buddy system for ISO 18404 portfolio development and a 1:4 Lean Coach to Candidate ratio.	Create your Lean dashboard early and standardise how you collect and display data and evidence you need for ISO 18404 certification.	Set the scope of ISO 18404 certification from the outset.

“Be brave and do the right thing. Commit to ISO 18404 from the outset, start by training the board and leadership team to ISO 18404 Lean competencies so they know what they are sponsoring. Good luck!”

The SMP Alliance Lean Production Steering Committee

Appendices

Pre-Assembly Make-Ready codes



* All acronyms can be found in the glossary.

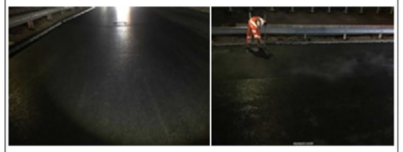
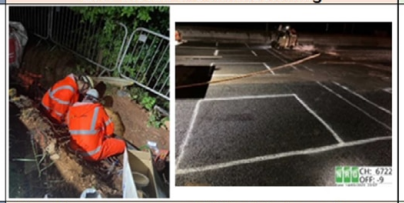
Assembly Make-Ready codes

Assembly Make Ready Codes (N=68)

	D	R.	P	A	M	P	P	S	S
	Design	Resources	Procurement	Access	Materials	Plant	Permits	Shared Understanding	Safety
Monthly	1 TQs Outstanding 2 RFIs Outstanding 3 ITPs not in Place 4 Survey Info Req'd 68 Works Examiner Inspection not scheduled	5 Personnel/ Resources req'd TBC 64 Inductions req'd	62 Procurement Req's not in Place	6 TM Req'd 7 Roadspace no Secured	8 MARs TBA 9 Materials not on Site	10 Plant Deliveries TBC 11 CCTV Req's TBC 12 Preventative Maintenance Schedule TBC	13 Enviro & Ecology 63 Permit to Dig 65 Quality Plan 66 Permit to Load 67 Overhead Permit	16 Site Visit not Conducted 17 Area Team req's / OD maintenance interface req's not Clear 18 Stakeholder Engagement not Complete 59 Contract not in Place 61 Lessons Learned to be pulled from another team	14 RAMS not Approved 15 TW req's not Approved 60 Width of safe working area insufficient
Weekly	19 Setting Out not in Place 20 ITP Check Sheets Need Prep 21 Machine Control Data Req'd 63 Works Examiner Inspection not scheduled	5 Personnel/ Resources req'd TBC 22 Supervision/ Engineering req'd TBC	62 Procurement Req's not in Place	23 Workspace & Access not Sufficient 24 Interface with other Trades Req'd 25 7 Day Weather Check TBC 26 Weather Contingency Plan Req'd	27 Logistics for Delivery TBC 28 Storage & Laydown Areas TBC 29 Material Spec TBC 30 Testing Schedule TBC	31 Plant not on Site 32 Plant Contingency not in Place 33 Lift Plans not Approved 34 Plant Inspections not Complete	35 Confined Space 36 Hot Works 37 Isolation 38 MEWP 39 TW 40 Defects 41 Noise 42 Pump/ Discharge 43 Slope inspection 44 Licences	16 Site Visit not Conducted 45 Ground Conditions not Checked 46 Works Examiner Req's not Clear 47 Predecessor not on track 61 Lessons Learned to be pulled from another team	14 RAMS not Approved
Daily	48 Correct Info to Build not Available	49 Labour Contingency Plan Req'd 22 Supervision/ Engineering 50 Right People/ Skills TBC 51 Optimal Gang Size TBC		52 Safe Access TBC 53 24 hr Weather Check TBC	54 Material Availablity TBC 28 Storage & Laydown Areas TBC	34 Plant Inspections not Complete 55 Small Tools Check not Complete	56 Permits still Req'd	58 Next Customer req's unclear	57 POWRA not in Place

* All acronyms can be found in the glossary.

Storyboard example

Dilapidation Records, Trial Holes & Service Diversions	VRS & Lighting Removal, Veg Clearance, Post Veg Clearance Survey & Design Confirmation	Topsoil Strip, Cut Slope & Hard Obstruction Removal	Drainage Installation	FOE, Earthworks &Capping
				
Survey & photographic records - Vac Ex trial holes dug at each side of the working area and at designated locations to identify any charted or uncharted utilities, (trail hole log completed). Depending on what is discovered determines how many holes are dug. Review use of below ground ducts for diversion outside of EA, where possible divert the live feeds away from the work area.	Vehicle Restraint System and plums removed to allow access to the work area. Hi-ab dependant items. Note seasonal constraints, consider chipping into EA to reduce movement waste associated with transit vehicle. Check design versus latest site information, particularly drainage. Survey drainage to outfalls if previously not conducted.	150ml Topsoil Strip, check for contamination, if it's the right quality keep and use, this was contaminated so went for waste. Flat level playing ground and allows good ground visibility. During this phase we were aware of a redundant sign base which turned out to be bigger than what was expected. Cut slope for parking and material storage in advance of permanent retaining solution, surcharge left to protect earthworks prior to permanent retaining installation (600mm).	3no excavations dug in total to install temp box and manhole box, 6no. manhole placed, drainage installed. Manhole boxed removed and backfilled. Trench box dug and drainage installed, joined up, air tested and backfilled. Attenuation 900mm carrier pipes 1no 300mm connection pipe, 3no 225mm, 2no 150mm & 225mm filter drain installed edge of carriageway and back filled with type 8 granular material. Formwork installed, Weir wall poured, formwork removed, Penstock installed.	Install FOE as small retaining wall including excavation, capping & narrow filter drain 100mm. Install subbase with surcharge to allow access from carriageway and comms installation.Box dig down to formation level, proof rolled, 215mm layer of capping stone compacted to spec followed by a further layer of 215 mm of capping stone compacted to spec, topped off with 250mm of type 1 compacted to spec (more accurate level surface for road construction).
Kerbs & Subbase	**Ducting Installation (Street lighting & Comms)**	**Tarmac Base & Binder**	**Raise Manholes**	**Top Soiling**
				
Instillation of CKDs, two part system so you lay twice as much. The base is laid on a concrete haunch then backed up with concrete, top unit laid and backed up again, this is the preferred method from the manufac. Subbase laid in 2 layers of 125mm on top of the capping. Narrow widening subbase compacted once hard shoulder step detail was planed out.	Comms Ducting installation, 4no. 110mmOD ducts installed to a depth of 600mm. 1no B–Chamber and 2no. E-Chambers (ERT & Loops). FOE to ERT E–Chamber and apron replacement at tie-in location.	Tarmac base (260mm) and Binder (60mm) installed. Sub base trimmed and Tarmac installed over plated manholes. Base grabbed in due to subbase step, review closure needs	Black top installed over plated manholes, tarmac cut out to expose the manhole openings, ironwork built-up to finished level.	Topsoil behind and in front of FOE, 450mm of topsoil (planting area) done whilst civils contractor on site. Mature plants installed. Seasonal - mulch mat requirement size, early wildflower seeding reduces erosion.
Install VRS	**Surface Course**	**Orange Overlay & White Lining**	**Cabling Power Comms, ERT Install & Commissioning**	**Verge finishes, Install Bollards & Sign Plates**
				
VRS installed in the traditional method until Infront of FOE when a Vac Ex was used. Use of Vac Ex in front of FOE due to limited space and to avoid rework when managing arisings. Volumetric for concrete.	CCTV drainage installation conduct post surfacing and remove any arisings. Laying final wearing /surface course (40mm).	Puma coat and Puma grip (Orange Overlay), resin - grit- orange overlay – skid testing for departure - white lining applied and studs.	All cabling power comms, ERT installed as well as reinstated loops in new position. All commissioning post TM removal.	Complete any outstanding snags during TM removal phase.

DHS M6 J4-5 EA Construction Flag on Edge (FOE) storyboard.

Standard Operating Procedure example

No	Process steps	Key points	Safety ✚ Quality ▲ Ease ●	Visual illustration
01	Start of Shift Briefing (SoSB)	• Talk through nights activity, define working areas (safe works and lift zones), confirm all materials on site including volumetric concrete.	✚ Agree lifting and work zones to allow concurrent working. ● Marking out and walk over to be done the shift before if possible.	
02	Mobilisation to site	• Confirm all vehicles have arrived to site. • Walk over works site and confirm it is as expected/SoSB. • Mark out pile (if not compilated prior shift).	✚ Complete point of works risk assessment. ▲ Install off set pegs to setting out to allow pile location to be checked as pile installed.	
03	Offloading materials	• Prioritise offload of Movax and pile casing. • Materials off load to be done via lorry HIAB to allow Movax to start casing install.	✚ Off load into agreed locations to prevent double handling and piling crew working in unloading area.	
04	Installation of casing	• Movax to start casing install ASAP. • Remaining off load to be done by lorry HIAB.	▲ Pile location to be checked as pile casing installed.	
05	Auger of pile	• Auger pile, focus on keeping Movax working. • Spoil handling team (grab) to be ready and waiting to deal with pile arising so work area not overrun.	▲ Concrete QA checks to be completed while auguring to depth to prevent delay to install.	
06	Concrete placement	• Place concrete into pile bore. • Prep Movax for next stages.	✚ Wash out facilities to be on site and ready prior to start concrete batching.	
07	Casing removal	• Pull pile casing and clean off. • Focus on keeping Movax working/attachment changes as smooth as possible.	✚ Clean down/wash out facilities to be on site and ready prior to start concrete batching.	
08	Plunge pile	• Plunge pile into wet concrete. • Focus on keeping Movax working/attachment changes as smooth as possible.	▲ Any concrete splatter to pile head to be removed with damp cloth to prevent paint damage. ▲ QA to be completed at point of works at this time to enshure everything is right first time.	
09	Reload materials	• Reloading of materials.	● This can start once pile casing works are complete.	
10	Demob from site	• All piling transportation and labour to leave site together once works 100% complete. This is to prevent items being missed and transport recalled.		

M6 J4a-10 plunge pile SOP, March 2024.

ALPS glossary

Term	Definition
3Cs	Concerns, Causes, Countermeasures
5S	Sort, Set in Order, Shine, Standardise, Sustain
7imes	Times (relates to SMP Alliance monthly internal communications)
AKA	Also known as
ALPS	Alliance Lean Production System
ALR	All Lanes Running (relates to smart motorways)
ALT	SMP Alliance Leadership Team
BIM	Building Information Modelling
BSI	British Standards Institution
CBA	Choosing By Advantages
CCTV	Closed-circuit television
CI	Continuous improvement
CKD	Combined Kerb Drainage units
Connec7	Connect (relates to SMP Alliance internal bi-annual magazine)
CP	Collaborative planning
DED	Digitally Enabled Designer
DHS	Dynamic Hard Shoulder (relates to smart motorways)
DR.PAMPPSS	Design Resources, Procurement, Access, Materials, Plant, Permits, Shared Understanding, Safety
DWO	Direct work observation
EA	Emergency Area
EDI	Equality, Diversity and Inclusion
Elmo	A Lean tool used to boost productivity in meetings and workshops and stands for, Enough, Let's Move On
ERT	Emergency roadside telephone
FOE	Flag on Edge
H&S	Health and Safety

ALPS glossary

Term	Definition
HELMA	Highways Excellence Lean Maturity Assessment (National Highways annually moderated assessment)
IFC	Issued for Construction
IGLC	International Group for Lean Construction
IRMA 360	Integrated Risk Management Approach
ISO 18404	International Standard for Lean and Six Sigma
ITPs	Inspection Test Plans
KTP	Knowledge Transfer Pack
LC	Lean culture
LCDP	Lean Construction Development Pathway
LCI	Lean Construction Institute
LPS	Last Planner® System
LPSC	Lean Production Steering Group
MARs	Material Acquisition Requests
MEWP	Mobile Elevated Work Platform
NEAR	National Emergency Area Retrofit programme (relates to smart motorways)
NEC4	New Engineering Contract version 4
NH	National Highways
NTL	National Training Laboratory
OD	Operations Directorate
OFI	Opportunities for Improvement
OSAP	On-Site Assembly Partner
OTEAMS	Opportunities, Threats, Elmo items, Assumptions, Make-ready items and Support requests
P13 ICG	Project 13 Infrastructure Client Group
PCF	Project Control Framework
PDCA	Plan, Do, Check, Act

ALPS glossary

Term	Definition
POWRA	Point of Work Risk Assessment
PPC	Percentage of Promises Completed
PPE	Personal Protective Equipment
RAG	Red, Amber, Green
RAMS	Risk Assessment Method Statement
RDMAICT	Recognise, Define, Measure, Analyse, Improve, Control, Transfer
RFIs	Requests for Information
RM	Risk management
ROI	Return on Investment
RSS	Royal Statistical Society
SA	Support Activity
SMART	Specific, Measurable, Achievable, Realistic, Time-bound (for setting goals that are attainable within a certain time frame)
SMP	Smart Motorways Programme
SMP Alliance	Partnership tasked with upgrading smart motorways over a ten-year period. Seven organisations including the client, National Highways.
SOP	Standard Operating Procedure
SoSB	Start of Shift Briefing
SVD	Stopped Vehicle Detection (relates to smart motorways)
TBC	To be confirmed
TM	Traffic Management
TMR	Tasks Made Ready
TQs	Technical Queries
TW	Temporary Works
VA	Value adding
VM	Visual management
VRS	Vehicle Restraint System

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8	WSP in the UK LinkedIn page	www.linkedin.com/company/wsp-in-the-uk/posts/?feedView=all
8	Balfour Beatty plc LinkedIn page	www.linkedin.com/company/balfour-beatty-plc/
8	bmJV (the BAM UK & Ireland/Morgan Sindall Construction	www.linkedin.com/company/bamukandireland/
8	& Infrastructure Joint Venture) LinkedIn page	www.linkedin.com/company/morgan-sindall/
8	Costain Group PLC LinkedIn page	www.linkedin.com/company/costain/
8	Project 13 Network LinkedIn page	www.linkedin.com/company/project-13-network/
8	Video: SVD retrofit case study	www.youtube.com/watch?v=JP0CbwlahDA
9	National Highways Lean guidance	www.nationalhighways.co.uk/suppliers/becoming-a-supplier/lean-supplier-support/
16	Lean Construction Institute UK	www.leanconstruction.org.uk/
16	Book: Lean Project Delivery – Building Championship Project Teams	www.umstotsolutions.com/lean-project-delivery-book
16	Book: Learning to Learn and the Navigation of Moods – The Meta-Skill for the Acquisition of Skills	www.amazon.co.uk/Learning-Learn-Navigation-Moods-Acquisition/dp/0692801790
16	Video: Destin Sandlin's backwards bicycle	www.youtube.com/watch?v=MFzDaBzBlL0
17	IGLC paper: Further reading on simulations	www.iglc.net/Papers/Details/991
19	Steve Ward's PhD research	www.leanconstruct.co.uk/wp-content/uploads/2024/02/Critical-Success-Factors-for-Lean-Construction-Intervention.pdf
20	Video: David Marquet's Turn the Ship Around!	www.youtube.com/watch?v=OqmdLcyES_Q
20	Book: Turn the Ship Around!	www.davidmarquet.com/turn-the-ship-around-book/
20	Book: Start with Why	www.simonsinek.com/books/start-with-why/
20	Book: Drive – The Surprising Truth About What Motivates Us	www.danpink.com/books/drive/
20	Book: Team of Teams	www.amazon.co.uk/Team-Teams-Rules-Engagement-Complex/dp/1591847486
21	Book: This is Lean	www.thisislean.com/
21	Video: This is Lean Management – Niklas Modig, at USI	www.youtube.com/watch?v=_VaVR4sExbs&t=20s
21	Video: Creating Flow in Lean Construction – A Step-by-Step Guide	www.youtube.com/watch?v=IFDqHsjKE8Q
21	IGLC paper: Critical Flow – Towards a Construction Flow Theory	www.iglc.net/Papers/Details/412
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21	IGLC paper: Shared Understanding – The Machine Code of the Social in a Socio-Technical System	www.iglc.net/Papers/Details/1409
25	Book: Value Stream Mapping	www.waterstones.com/book/value-stream-mapping-how-to-visualize-work-and-align-leadership-for-organizational-transformation/karen-martin/mike-osterling/9780071828918
25	Book: Six Thinking Hats	www.penguin.co.uk/books/56270/six-thinking-hats-by-bono-edward-de/9780241257531
25	Book: Building Lean Building BIM	www.taylorfrancis.com/books/mono/10.1201/9781315300511/building-lean-building-bim-rafael-sacks-samuel-korb-ronen-barak
25	Book: Lean Construction 4.0	www.taylorfrancis.com/books/edit/10.1201/9781003150930/lean-construction-4-0-vicente-gonz%C3%A1lez-farook-hamzeh-luis-fernando-alarc%C3%B3n
25	Book: The Lean Builder	www.theleanbuilder.com/product/the-lean-builder/
25	Book: The Art of the Builder – Takt Planning	www.elevateconstructionist.com/resources/books//
30	National Highways Lean guidance	www.nationalhighways.co.uk/suppliers/becoming-a-supplier/lean-supplier-support/
30	2020 Current Process Benchmark for the last Planner® system of project planning and control	www.p2sl.berkeley.edu/wp-content/uploads/2021/03/Ballard_Tommelein-2021-LPS-Benchmark-2020-2.pdf
30	A Facilitators Guide to the Last Planner® System	www.core.ac.uk/download/187115131.pdf
30	2016 Current Process Benchmark for the Last Planner® System	www.p2sl.berkeley.edu/wp-content/uploads/2016/10/Ballard_Tommelein-2016-Current-Process-Benchmark-for-the-Last-Planner-System.pdf
30	IGLC paper: Make Ready Planning Using Flow Walks – A New Approach to Collaboratively Identify Project Constraints	www.iglc.net/Papers/Details/1598
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44	Book: Choosing By Advantages – How to Make Sound Decisions	www.amazon.co.uk/Choosing-Advantages-Make-Sound-Decisions/dp/1946637335
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57	IGLC paper: Systematic Approach to Making People, Processes & Projects Ready for Make-Ready	www.iglc.net/papers/Details/2303
57	Integrated Project Delivery at National Highways	www.leanconstruct.co.uk/wp-content/uploads/2024/02/IPD-full-report-v4-14-9-23.pdf
57	IGLC conference proceedings	www.iglc.net/Papers

national highways | smp alliance