COMPANY OVERVIEW

COMPANY WEBSITE
www.graham.co.uk

GRAHAM works on building, civil engineering, and fit-out projects for both public and private sector clients across Ireland and the UK, and is currently on more than 100 sites. GRAHAM has offices in Hillsborough, Belfast, Dublin, Aberdeen, Glasgow, Dumfries, Edinburgh, Durham, Manchester, Leeds, Birmingham, Cambridge, St Albans, London, and Bristol. Our core markets remain strong given the UK Government's infrastructure spend and a strong pipeline of opportunity in building, interior fit-out, and facilities management. We currently employ more than 2,000 people across the GRAHAM businesses.

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OVERVIEW OF THE LEAN INITIATIVE

GRAHAM has been on its Lean journey for 18 months and has focused Lean deployment within two isolated areas of the business: Civils Highways and Buildings. This case study details the findings and shared common themes across these two business functions, drawing on two distinct projects and detailing the lessons learned, the benefits, and the next steps for the business.

BACKGROUND TO THE LEAN INITIATIVE

The case study explores a range of Lean approaches across two projects, in particular the adoption of Collaborative Planning and Last Planner® System (LPS) (note that these terms are used interchangeably and are intended to mean the same thing).

Project 1: Civil Engineering Business – Collaborative Programme Planning
GRAHAM Civils Highways had only 6 months to deliver 72 schemes worth GBP£19M across Highways England's strategic network. It was imperative that the whole project team worked collaboratively to deliver the scheme. The Project Leadership team, which had successfully used collaborative planning on other projects, fully supported and implemented collaborative programme planning and production control approaches to drive the programme. This project draws on the successes and lessons learned.

Project 2: Building Business – Lean Integrated Project Delivery and Last Planner® System
GRAHAM Buildings is building a new warehouse, laboratory, and atrium connected to an existing office building on an existing enclosed manufacturing site. The Client is a large global manufacturing company and the USD$50M project is due for completion in 2021.The Client introduced Lean Integrated Project Delivery (IPD) to the project in Jan 2018.

LEAN INITIATIVE UNDERTAKEN – LEAN THINKING, TOOLS, TECHNIQUES

GRAHAM understood that it needed to be bold and challenge current practices through working more closely with its suppliers to continuously improve. Gaining competitive advantage in such a fiercely competitive industry is a challenge in itself. As in other industries, customers are expecting more for less, and certainly greater reliability in delivering projects on time and on budget. Despite Lean Deployment happening in two totally segregated areas of the GRAHAM company, the common objective remains the same: to deliver the best possible value project to the Client in the shortest possible time, at the best possible cost, whilst ensuring the highest standards of safety, quality, excellent relationships, and efficiency at all levels.

Project 1: Civil Engineering Business – Collaborative Programme Planning
The "Operations Directorate East Lot 2" forms part of Highways England's Roads Investment Projects (RIP schemes) whereby work is allocated to GRAHAM through framework. Success of the first package of works secures future packages of works through the framework for GRAHAM.

The GBP£19M package of works included a variety of 72 smaller schemes, including major bridge repairs, resurfacing works, and a number of small vehicle restraint systems, signage, and site clearance, all to be delivered within 6 months. The geographical location of the works spans over 72 miles. The original programme meant that our teams would have to put out traffic management, causing disruption to the travelling public on a particular stretch of road – for example to do a small amount of resurfacing and then three months later to come back to the same area to conduct a different type of work. GRAHAM recognised an opportunity to reduce over-production and rework by making the location of each scheme visual within our visual management room and using collaborative planning to reprogram the whole package of works.

This allowed the team to re-sequence works in a similar geographical location to make larger schemes, thus reducing time and cost and providing subcontractors with continuation of works within larger sections of traffic management and make the commercial side much more efficient. A planning workshop was held, which was inclusive of the Client, design, and construction teams, to set up the collaborative planning board. As a team we mapped the process that all 72 schemes would go through.

Figure 1. GRAHAM Collaborative Planning Process.

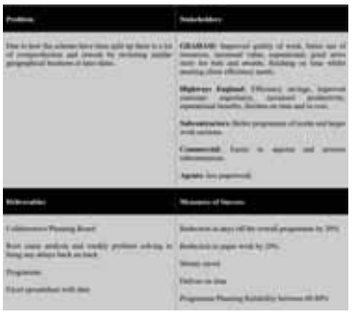

Table 1. GRAHAM Lean Workshop QUAD of Aims.

The team batched the schemes by location titled "A" to "O" and then designed a magnet for each scheme. This included a section for cost and time, boxes for dates of next milestones, and general information about the scheme pin and budgets. The team decided to use red, amber, and green as status magnets:

- Amber = On Track
- Red = Behind Schedule
- Green = Ahead of Schedule. (It is hoped that Green will indicate some efficiencies and make them easier to track.)

Next, the team decided on how the meetings would be structured, on which days they'd be held, and who would attend. If anything appeared in red, then the team would identify the blockers and find the root cause to improve the process.

Figure 2. GRAHAM Scheme Process.

Project 2: Building Business – Lean Integrated Project Delivery and Last Planner® System

GRAHAM Buildings is presently constructing a new warehouse, laboratory, and atrium connected to an existing office building on an existing enclosed manufacturing site and the un-used office building is being partly demolished and completely refurbished. The Client had significant success with Lean IPD in the US, and was keen to share that best practice in its European operations. The Client chose to use Lean IPD despite this project already having been underway for over 12 months and most of the design activity being already completed. One of the core reasons for selecting this project was because the USD$50M project needs to be completed in 2021 to meet a critical Client handover date.

Integrated Project Delivery (IPD)

IPD is the project delivery process for when an Integrated Form Of Agreement (IFOA) contract is applied, and it involves the client, designer, and contractor operating as a fully integrated team under one legal entity. The process starts at project conception, through to concept verification, design, development and construction. In simple terms, Lean IPD is the combination of Lean, IPD, and BIM. The IPD procurement method complements Lean deployment in several ways. The core element of IPD is the concept of flow – maintaining constant, consistent, and connected work. In a perfect flow operation there should be zero waiting time. With IPD, the aim is to bring the team together early, start with the business case, decide the affordable cost, then bring the team in to work out how to achieve that cost. The next phase of work is focused on collaborative design, which is the beginning of encouraging the team to work efficiently and effectively together. Everyone has the right to challenge. Everyone is expected to deliver on their commitments. If set up correctly, change notices should almost go away and requests for information reduce because the team is already working together. Adopting and integrating new technology, such as BIM and Virtual Reality, into the IPD approach can further improve schedule and budget performance provided a right-first-time mindset exists and is followed by all concerned.

Some benefits of IPD include:

- Early Collaboration – Partner selection starts early with partners included on the team right after feasibility. This early collaboration during the design phase enables huge opportunities to reduce Lean waste, thus reducing scope, cost and schedule. This allows enables full transparency of information, including commercial content.
- Aligned Goals – IPD uses incentive-based contracts. Traditional contracting strategies encourage spending. With IPD, the more the aligned team save, the more profit they make. This alignment makes all the difference, and it motivates the behaviours needed to increase collaboration and innovation. The alignment of project control is a further benefit, moving people away from blaming others for issues and moving towards true team thinking.
- Shared Risk – An agreed target cost using an activity schedule wherein upon completion of the project the difference between the actual price and the agreed target price will be shared between the parties through a gain-share/pain-share contract.

The Client defines IPD as incorporating the following seven essential tools which were all implemented on this project:

1. Partner selection
2. Collaborative Design Sessions (CDS)
3. The Big Room
4. Conditions of Satisfaction (CoS)
5. Target Value Design (TVD)
6. Last Planner® System (LPS)
7. Integrated Form of Agreement (IFOA)

Challenges and Initial Action

The UK activity started in February 2018 and the project team involved people from the USA Client, the UK Client, GRAHAM, senior executives from the main sub-contractor companies, and representatives from other organisations providing specific expertise. The biggest challenges faced by the project team was the necessary mindset and behaviour changes needed to introduce a completely new contractual arrangement in addition to the new Lean project

management process – and all during a live and ongoing project. A number of workshops were held. One workshop stream focused on the development of the new contractual arrangement. The second workshop stream focused on developing shared understanding of Lean IPD and enabling project launch. These workshops started with senior executives from the core team who developed the initial milestone plan and later included representatives from all of the sub-contractor companies. The workshops were structured to include a combination of Client-led presentations, practical exercises and open-forum discussions.

Figure 3. GRAHAM Milestone Plan Development.

Conditions of Satisfaction (CoS)
One key objective in these initial workshops was to develop shared understanding of the Client's conditions of satisfaction (CoS). The CoS are an explicit description by the client listing all requirements that must be met by the project team for the project to be recognised as successful. Ideally the CoS should always include cost and schedule, but can also include 6-8 statements overall. A further consideration is agreeing a process of measuring and tracking how well the team is doing against these conditions throughout the life of the project as understanding the current status is as important as the conditions themselves.

Integrated Form Of Agreement (IFOA)
This project is one of the first, or possibly is the first, use of IFOA in the UK, and it forms part of the overall IPD approach. This multi-party contract normally includes, at a minimum, the owner, designer, and constructor as signatories to the same construction contract. The agreement can include over a dozen parties when key sub-contractors, suppliers, and trade partners are added. For this project, the signatories included the Client, GRAHAM as the main contractor, and the Mechanical & Electrical sub-contractor. The designer was not included as most of this work had already been completed and further collaboration would deliver minimum benefit to the overall project team.

Collaborative Design & Scoping (CDS)
The next phase of work for the Client project team was to hold a number of facilitated Collaborative Design & Scoping (CDS) workshops, which included the Client, designers, sub-contractors, and key trade partners. The team was reminded of the Client's CoS, the need for scope development through Lean waste reduction, and that respect for people is a fundamental ground rule for collaborative working. In fact, a common phrase used by the facilitators was "Please leave your badge at the door – everyone in the room is to be treated equally". At the end of each workshop, feedback was obtained from the participants in the form of "Plus Delta", where "Plus" represented positive feedback and "Delta" represented constructive feedback. The facilitator's aim was to resolve the constructive feedback in time for the next workshop, where this was feasible to do so. At the end of the collaborative design workshops and target value design activity, the IFOA multi-party contract was signed by representative parties.

Figure 4. GRAHAM Collaborative Design Workshop.

Big Room
The Big Room is an on-site location where stakeholders were co-located and could therefore work together. Once the contract had been signed, the project team moved to the Big Room that had been set-up at the Client construction site. Other key stakeholders co-located to the Big Room space during key phases of the project activity.

Collaborative Planning
The Big Room space was, and continues to be, the location for all construction related collaborative and commitment-based planning sessions which follow the "should-can-will-did-learn" planning approach. These weekly facilitated sessions take place every Thursday morning and involve pull planning, constraint analysis, weekly work planning, and reliable promises. Team and project learning is captured through the use of Percent Promises Kept (PPK) and Reasons for Variance, with root-cause analysis applied where there is value in doing so.

In preparation for the introduction of collaborative planning on this project, a team workshop was held focused on the 8 Wastes to highlight opportunities for improvement (OFI) prior to launching the next construction phase. A total of 88 suggestions were put forward which when consolidated, covered five categories: people, construction, materials and logistics, documents and information, and commercial.

Examples of the 88 OFIs raised include:

- Reduce language barriers
- Talent exists but not best utilised
- Potential to share work between contractors not understood or communicated
- Waiting on other contractors to get their work completed
- Stocked items getting damaged
- Overproduction of waste – waste material not being properly broken down
- Materials stored away from the work location
- Over-ordering of materials
- Information/drawing sign-off needs
- Waiting for design work to be completed/signed-off

The one common element that links all of these suggestions is the mindset of the people engaged on the project.

LEAN INITIATIVE IMPROVEMENTS & IMPACT

Project 1: Civil Engineering Business – Collaborative Programme Planning
The engagement, development, and training of the team supported the philosophy of Lean as evidenced by flexible motivated teams challenging and improving their own processes. The success of this initiative was down to extensive and true collaboration between design, construction, the Client, and everybody else attending. Learnings were

transferred to our Highways England Knowledge Bank, Lean Tracker, and Efficiency Register. The learnings will also be transferred to the M40, another Highways England scheme, and will form part of a joint award for the supplier recognition awards.

Areas of Improvement include:

- Cost Savings – GBP£560k saved to-date
- Collaboration – Improved relationships with the Client and designer
- Reduction in Paper – Blanket Temporary Traffic Regulation Orders and Risk Assessment Methods
- Delivery Confidence – Although some programme milestone dates have slipped, many have been pulled forward and reduced giving GRAHAM full delivery confidence
- Mapped meeting structure
- Mature the process and repeat planning sessions
- Made the Collaborative Plan Mobile
- Root cause analysis on non-delivery
- Explored potential to compress the schedule.

The Lean initiative has already highlighted clear opportunities and unexpected challenges. There is growing recognition of the need to review and improve company culture and build greater collaborative partnerships within the supply chain. Engagement of clients, partners, and suppliers in collaborative planning and/or the adoption of LPS has introduced a different mindset, and the GRAHAM Lean journey is very much under way.

Project 2: Building Business – Lean Integrated Project Delivery and Last Planner® System

The adoption of a full Lean IPD approach by the Client on this project is believed to be the first of its kind in the UK. The seven essential tools resulted in many benefits.

Conditions of Satisfaction

Sharing the Client's CoS provided clarity about customer expectations for project delivery performance and the means by which to visibly and openly measure and report ongoing "current status" in the Big Room collaborative space. By openly declaring, tracking, and sharing the CoS, the project team was able to take immediate action where necessary. Two of the Client's CoS for this project are:

- Meet cost target: USD$50M budget for everything
- Meet schedule: Linked to regulatory requirements

Integrated Form of Agreement (IFOA)

The IFOA contract is being used on this project, potentially for the first time in the U.K. Due to the timing of its introduction and the ongoing duration of the project into 2021, evidence of the benefits gained are still too early to capture or report.

Collaborative Design & Scoping (CDS)

By adopting collaborative working, the team was able to validate schedule milestones, identify design improvements and identify work processes where additional Lean IPD activity could add value. When capturing the Plus/Delta feedback, it was not uncommon to learn that many of the sub-contractors had never been involved in the design activity before and how much pleasure they gained from doing so.

Big Room

The Big Room shared space enables open communication and has already highlighted OFIs in terms of more efficient workflow and opportunities to reduce Lean waste, including potential rework. The shared space also enables visual management including space for visual tracking of key information such as the CoS, cost projections, schedules, and site drawings. Further benefit has been gained through increased collaboration by enabling access to digital tools such as BIM, conferencing, and internet access.

Collaborative Planning

A benefit captured on Project 2 was the realisation by the project team that a task is not complete ('done') until the customer of that action is content ('done done'). Although this took time to embed, the project team are now used to these terms, to being challenged about commitment completion, and understanding what is now expected in terms of delivering on original promises. The value of the PPK process is now more widely accepted as a method to deliver significant performance improvements to a project in isolation of any other best practices.

The project has only recently started the construction phase so further benefits are yet to be realised; however, in advance of delivering benefits on their own construction project, the GRAHAM team has identified a number of lessons learned:

- If there is a true desire to improve the current status and this desire is supported by the stakeholder team managers, then significant improvements in revenue and time can be accessed simply by engaging everyone involved and seeking ways to improve processes and systems of work.
- If the team can't agree on the problem, how on earth will they ever agree on the solution. Co-locating the full project team will speed up communication and decision-making.
- Without focus on continuous flow, errors cannot be caught or dealt with quickly because if they occur they tend to be hidden from plain sight.
- As this is a process involving humans, it would traditionally be up to one person to decide what is prioritised first. Through collaboration, combined learning and knowledge can be used to add wisdom to the decision-making process.
- In construction, re-work is almost expected as the norm. What can we do to minimise this waste?
- A common and shared Lean strategy is needed across all GRAHAM business units.
- For Lean to be sustainable, standard procedures and standard operations need to be identified and documented.
- Sceptics will and do exist. Ensuring effective knowledge transfer to senior management and employees across the group is important once further benefits have been achieved and documented.
- GRAHAM recognises that it needs to communicate the "why" of Lean as well as the "what" and the "how". Everyone will need to understand why the new approach is necessary and that a continuous improvement mindset must become the norm.