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John Paul Construction is a leading building and civil engineering contractor with a long-standing reputation for integrity, professionalism, innovation, and excellence. With more than 70 years' experience across all sectors of the construction sector, our success is built on an uncompromising dedication to quality and service.

We put our Clients' interests first, providing a level of service that enables them to concentrate on their business in the knowledge that their project is in safe hands. One of our key strengths is our ability to forge strong partnerships and long-lasting relationships across clients, professionals, and supply chain. We are owner-driven and passionate about our work, with a hands-on collaborative approach and genuine commitment to delivering value and excellence in everything we do. Construction is all about people and performance, and our people are skilled and highly-trained with the experience and ability to deliver the most complex and challenging projects within demanding project deadlines and meticulous quality standards.

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Overview & Background to the Lean Initiative

As turnover levels increased, and as the demands on all levels of management and subcontractors increased, John Paul Construction recognised that improved efficiencies, including methods of short-term planning, was required on sites. This requirement was also heightened with the undertaking of fast-track projects due to demands by clients to reduce durations on site and deliver projects in an accelerated manner due to their business-driven deadlines.

As part of our approach to meet these demands and improve sustainability and efficiencies for our clients, John Paul Construction has adopted Lean principles and our Lean initiative commenced with the introduction of the Last Planner® System (LPS) across a number of projects. Training in LPS, which was supported by Enterprise Ireland, was introduced across various projects, including: a residential development, a city centre hotel development, and the Lidl Regional Distribution Centre (RDC) in Newbridge (entitled "Newbridge 2").

In addition to LPS, which was utilised on Lidl, we also used our relationship with the client which was developed at tender stage to openly and collaboratively challenge the tender design through detailed Value-Engineered proposals. The purpose of these proposals was to introduce proven Lean initiatives utilised on a range of industrial projects undertaken by John Paul Construction that were proven to reduce waste, improve the project schedule, and increase off-site fabrication to bring an overall increase in on-site efficiencies and assist the team in delivering the project.

This case study explores some of these Lean initiatives that secured the contract for John Paul Construction and successfully delivered the project on time and on budget with minimal defects.

Lean Initiative Undertaken – Lean Thinking, Tools, Techniques

As the single largest investment by Lidl in Ireland, "Value from the Customer's point of view" on Newbridge 2 not only encompassed the delivery of the project on time and on budget, it also provided an opportunity for the Irish Construction team within Lidl to showcase to their Lidl International colleagues the added value that real collaboration between designers and contractors can deliver when given the opportunity to do so.

John Paul Construction therefore recognised at tender stage that the Irish team within Lidl had to deliver tangible results of a Lean approach to building, and that investing energy and deploying resources into challenging the status quo from the earliest planning stages of the project to drive Lean thinking would be like "pushing an open door" and not set the contractor and designers on an inevitable route to conflict. It was therefore clear from the outset that all stakeholders – Client, designers, contractors, and suppliers – were open to collaboratively delivering value by identifying and driving the Lean processes and techniques that would be deployed to deliver this value.

First and foremost, it is important to understand the project was all about scale and that marginal improvements had the potential to deliver real and tangible gains in the same way wasteful or inefficient practices are magnified to the detriment of a project and its commercial performance.

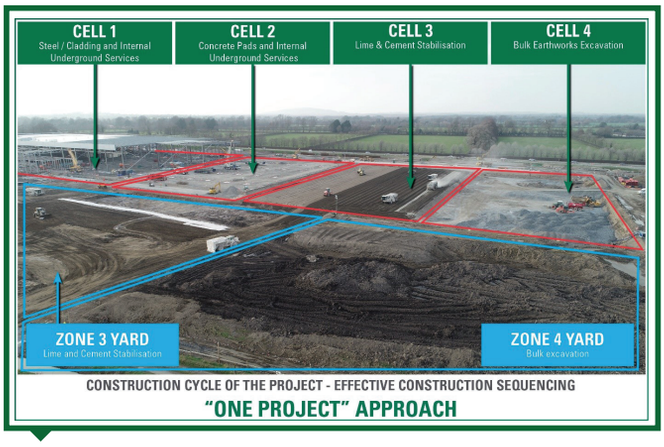

Figure 1. "One Project Approach"

Scope of Works

The works comprised the construction of:

- A new build high-bay warehouse building with a gross floor area (GFA) of 58,032 m2, including:
  - Warehouse element maximum parapet ridge height of c.17.9m and overall dimensions of c.124m in width and c.437 in length.
  - 20,068m2 of temperature-controlled storage chabers, ranging from a 4,300m2 "-24o freezer" to a 6,000m2 fruit and vegetable storage facility.
  - High bay and dynamic racking to "ambient" cross-dock warehouse space.
  - Associated mechanical and electrical services.
  - Two high-specification finished administration buildings (1,790m2 GFA and roof height of c.10.6m).
  - 154 Dock Levellers.
- Earthworks enabling package:
  - 370,000m3 bulk earthworks.
  - 330,000m3 lime and cement stabilisation.
  - 4.2km Tubosider drainage system (1400mm diameter).
- 80,000 m2 of external concrete truck parking and services yards.
- 300 car parking spaces.
- Largest building-mounted photovoltaic array in Ireland comprising 4,364 panels capable of generating over 1-million kWh hours per annum.

Works were scheduled to commence in September 2018, and the brief called for the facility to be delivered by October 2019 to meet peak Christmas demand and provide appropriate additional warehousing space for Lidl to store stock in order to address uncertain Brexit outcomes.

Across four areas – Groundworks, Facilities, pecification, and Sustainability – the programme targeted delivering:

- Groundworks: An engineered design and build ground treatment solution to provide a suitable platform on a site with poor natural ground conditions to construct the warehouse.
- Facilities: A curtailed transition period between construction and operations by integrating Lidl IT, its network and order picking systems, as well as mechanical handling equipment deliveries into the main build programme.
- Specification: A "head office" specification administration block for staff and a warehouse building that met Lidl International design standards.
- Sustainability: One of the most sustainable and energy-efficient logistics centres in Europe with A1 energy rating and BREEAM Excellent Standards in design and construction.

Projects of scale, with many duplicated details, demand a production mindset to deliver consistency and avoid rework, and thus a Lean approach is tailor-made for this kind of project. The strategy deployed by John Paul Construction during early planning was to explore and deliver on marginal gains in every work package, and to understand and mitigate project risk through careful planning and contingency planning.

From early planning stages during the tender, technical and commercial risks and opportunities were identified and recorded in live registers from detailed interrogation of the works requirements, multiple visits to recently completed RDCs in the UK, and knowledge sharing with supply chain partners, many of whom had worked on similar Lidl Projects in the UK and Europe.

Ultimately Lidl would have the final say in relation to all initiatives identified; however, the following schedule identifies some of the technical efficiencies delivered by our Project Team through deployment of Lean thinking from the outset:

- Project acceleration to mitigate delays incurred pre-commencement on-site.
- Groundwork strategy that eliminated off-site disposal in favour of treatment and reuse on-site.
- Overall review and redesign of drainage, foundations, structural steel, and roofing to reduce quantities, improve installation efficiencies, and provide an overall cost and programme benefit to the project.
- Early selection of pre-lagging mechanical and refrigeration pipework, and off-site lagging of refrigeration plant, significantly reduced the typical refrigeration commissioning periods.
- Increased off-site assembly of electrical, mechanical, and sprinkler components to accelerate first-fix works.
- Utilising pre-fabrication for walls and buildings where possible to improve installation times.

- Use of Revit and 3D planning to create "no fly zones" through high-level services to aid access and future maintenance.

Tools Deployed to Deliver the Lean Approach

Viewpoint

The entire project team used Viewpoint as a Common Data Environment (CDE) for the sharing and dissemination of all information and project records, with bespoke workflows established from the beginning of the project for technical submittal approval processes, benchmarking process, and the tracking of RFIs. This ensured fast-track production could proceed on a large scale with a clear understanding of acceptable standards and performance metrics.

Fieldview

This is a cloud-based and off-line mobile solution that replaces pen and paper in the field, and it was used by the entire team for inspections, including: safety inspections, quality observations (both good and bad), BCAR inspections, snagging, technical queries, benchmarking, and sample approvals to track and close-out issues as they arose. Having single portals for tracking actions and sourcing information proved vital to the delivery of such a large-scale fast-track project.

LPS

For short-term planning and scheduling works on site, we utilised LPS which is a well-established and trusted collaborative planning system used across multiple John Paul Construction sites and which focuses on better short-term planning by all the stakeholders involved in the delivery of specific tasks.

LPS training was arranged early in the contract for the entire supply chain, and was delivered by Lean Touch Solutions Ltd who were brought on board to review the specific needs of Newbridge 2 and support the team. Additionally, an on-boarding workshop was given to the senior team to give a high-level overview of the Lean programme and explain the phases and elements of the LPS programme. This set the LPS vision among the senior stakeholders on the project and allowed the team to develop a Lean implementation plan for Lidl. Following the on-boarding, Lean Construction and LPS training was provided to the senior members of our team along with the key personnel from the key subcontractors who were working on the project. Our commitment to providing this training, along with the subcontractors' commitment in terms of attending the training days during the start of a fast-track project, demonstrated the entire team's intent in ensuring that LPS would be implemented on site.

Due to the scale of the Lidl project, the LPS was implemented in a twin approach with separate pull plans prepared for the civil works and the building works. The project managers for each section worked with Lean Touch Solutions and the subcontractors to generate the initial Pull Plan and agree the key milestones for each section. Crossover points between the building and civil works were managed by regular communication between the team leaders. The implementation of regular meetings and huddles to facilitate the pull plans, weekly planning sessions, and daily huddles was a challenge, but all members of the team, with continued support and training from Lean Touch Solutions, ensured that the system was bed-in over a period of time to allow it to assist in bringing a successful outcome on the project.

Figure 2. LPS Meeting

Overall, the implementation of LPS on Newbridge 2 improved schedule accuracy, cost control, quality and health and safety.

BIM

John Paul Construction employed several digital tools to manage the different aspects of the project. A client requirement called for the project to be delivered in line with the Fundamental Principles of Level 2 Information Modelling stipulated within PAS1192-2:2013. We thus produced a model production delivery table (MPDT) at the start of the project to plan out the BIM model delivery. This defined who was responsible for each element of the model and to what level of detail they were required to develop. This was continually updated throughout the project and mapped the model development from stages 3 (Developed Design) through to stage 6 (As-built and handover).

The fully integrated, coordinated, and up-to-date BIM model allowed the site team to accurately set-out all elements from the model, to generate live as-built records, and to use tablet applications such as "Dalux Viewer" to compare virtual views of the planned installation against actually completed works. The approach to BIM delivery was recognised by the Lidl design team (who work on many similar projects across the UK for Lidl) who acknowledged that the John Paul Construction approach went beyond anything they had seen to date from main contractors in the UK.

Figure 3. BIM Example

Drone Technology

A heavy reliance on drone technology aligned with the BIM model, allowed John Paul Construction to manage bulk earthworks in real-time and eliminated disputes with subcontractors over measures and quantities of materials placed on site. The drone survey footage was processed within "ReCap Photo" to produce a point cloud of the site each week, and these point cloud surveys were used for a cut-fill analysis of works completed. A site-wide drone fly-around was undertaken once a week, and this footage was utilised for project reporting and works quality, as well as for client meetings reviewing works ongoing and completed.

Figure 4. Completed Project Exterior View

Lean Initiative Improvements & Impact

Newbridge 2 was delivered on budget and on time as a direct result of the Lean approach adopted by John Paul Construction from the earliest planning stages of the project. It was an immensely satisfying project to work on, where everyone from the client and design side, to the contracting team and supply chain pulled together and rose to every challenge with a level of professionalism and control that ensured the quality of the end-product was never compromised.

Standout features that contributed to the successful delivery of Newbridge 2 include:

- The pre-eminence of the Project-need over individual self-interests, allowing design intent to be interrogated in favour of more efficient solutions.
- The implementation of LPS which was led by our project managers and implemented by the supply chain to bring efficiency to the project schedule.
- The commitment to BIM execution and standardised project systems that helped streamline the flow of information between design and operations.
- The synergies achieved between the JPC Civil's team and the Main Build team allowed the envisaged enabling works lead time to be considerably reduced to preserve the end date.
- Selecting a familiar supply chain with a proven track record in collaborative fast-track industrial facilities and creating an environment on-site that could leverage their expertise to optimise the delivery of the project and meet the onerous project completion milestones.

Figure 5. Completed Project Interior View

Project Testimonials from the client and design team speak to the collaborative approach and use of Lean thinking and practices from early stage through to handover.

Lidl (Client):

"The entire project was designed, coordinated, planned, and installed using BIM. This approach provided an invaluable tool to both the design and delivery teams in early clash detection and avoidance, and also ensured that the building successfully met and exceeded our requirements. Their delivery team executed the works in a very efficient, professional manner and to a high quality and standard whilst fully engaged to successfully deliver a BER A-rated warehouse, BREEAM Excellent, and full validation of BCAR."

JV Tierney & Co (Services Consultant):

"John Paul Construction's task was to coordinate, construct, and commission the Distribution Centre to operational specification within 12 months. John Paul Construction achieved this with a collaborative approach to the project. They enacted on-site policies to ensure good communication between all stakeholders and the use of BIM to enable off-site fabrication, thus ensuring a quick and safe installation on-

required of the building services, including sprinkler protection integrated into the racking and waste heat from the temperature-controlled areas linking to the heating system. John Paul Construction also incorporated late instructions for additional works into the building programme. The 1.2 MegaWatt Solar PV installation is a good example of this, and it is the largest rooftop PV array in Ireland."

From the above testimonials, it is clear that our adoption of a Lean Approach to Newbridge 2 delivered on its value commitments to the Client, collaboratively challenging established construction details across the work packages, coordinating the works effectively using the latest digital tools to minimise waste, supporting off-site innovation, and using production planning tools and quality control systems to deliver the project on time and to the necessary quality.

John Paul Construction believes that it is possible and necessary to continuously improve processes and eliminate waste in lines with Lean philosophy.