COMPANY OVERVIEW

BANAGHER PRECAST CONCRETE

COMPANY WEBSITE
https://bancrete.com/

Banagher Precast Concrete (BPC) specialise in precast bridge beams and is the leading manufacturer and supplier of precast concrete products to the civil engineering and construction sector throughout Ireland and the UK. Precast concrete products include reinforced items such as bridge beams, columns, terrace units, walls, parapets that are used by the construction sector for large-scale buildings, viaducts, tunnels, bridges, roads, rail, marina, and stadia. Its dedicated staff of over 250 people have been committed to providing clients with a complete service, including value engineering, design, manufacture, and installation of precast concrete products for over 60 years.

OVERVIEW OF THE LEAN INITIATIVE

This project involved the re-development of the Páirc Uí Chaoimh Stadium in Cork, Ireland, into a 45,000 capacity GAA Stadium, and with a budget of €80M.

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BACKGROUND TO THE LEAN INITIATIVE

BPC started Lean training and implementing Lean processes in 2014 in a bid to reduce waste and drive continuous improvement (CI) within the company. BPC's production facilities cover a 50-acre site with 70 gantry cranes and multiple production lines, and thus there were many opportunities to employ Lean to ensure a safer and more efficient production plant. At the directors' monthly Lean meeting the metrics were reviewed and the search began for Lean ideas. Although complicated, large-scale precast projects lend themselves to repetition of work and guaranteed volumes, and this in turn makes them ideal for the implementation of Lean to remove waste and inefficiencies. When BPC won the Páirc Uí Chaoimh contract it was identified as an ideal project on which to implement Lean thinking and processes to reduce waste and eliminate rejections, to drive efficiencies, and to ensure the delivery of best-in-class high-quality precast products in full and on time to the Client.

LEAN INITIATIVE UNDERTAKEN – LEAN THINKING, TOOLS, TECHNIQUES

Implementation of Building Information Modelling (BIM)
Traditionally BPC design a project plan from the conventional 2D drawings provided by clients, but with large-scale projects this approach has the potential to substantially increase errors as there is no clash-detection programme involved. This in turn can result in under-supply or over-supply, product discrepancies, stock-holding, and delays.

Figure 1. BPC Ireland Site.

BPC is Level 1 BIM compliant, and has been using the industry-recognised BIM system since 2010 – but only on projects where the contractor has required its use. It is one of the Managing Director's key aims to attain Level 2 BIM as per new industry requirements.

BIM extends beyond 3D by augmenting the three primary spatial dimensions of width, height, and depth, with time as the fourth dimension (4D) and cost as the fifth (5D). It is an intelligent system that interlinks all elements of a build to detect potential project conflicts and collisions. BIM is used from the pre-design phase onwards to drive analysis, schedules, production, logistics, and construction. The BIM concept envisages virtual construction of a facility prior to its actual physical construction to reduce uncertainty, improve safety, work out problems, and simulate and analyse potential impacts.

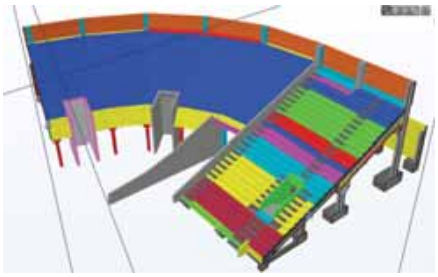

Figure 2. Example of BIM used on Páirc Uí Chaoimh Project.

In this instance the contractor did not require the use of

BIM, but as part of BPC's Lean strategy it was decided to use BIM anyway for internal use to map the entire project to remove waste, to implement right-first-time (RFT), and to deliver just-in-time (JIT) rather than holding stock. The detailed modelling of the structure provided BPC with the requisite information to avoid errors, to map a concise manufacturing schedule, and to ensure delivery in full as products were required on site.

The primary issue with using BIM is that the initial set-up of a BIM model is extremely time consuming and requires absolute precision detailing. It also requires commitment from the entire team from the outset and throughout the entire lifetime of the project. When BIM is not a client requirement, the leap to implementing it internally on a project is a significant break from the traditional way of operating.

Figure 3. Timber Mould with Rebar Cage In-Situ Before Concrete Pour.

Mould Efficiencies

Precast concrete products are manufactured off-site and include reinforced items such as bridge beams, columns, terrace units, walls, and parapets used to create everything from buildings to bridges and stadia. The process of manufacturing precast products includes steel and timber moulds – a rebar cage is dropped into a specially designed mould and concrete is then poured into the unit and left to set. New steel moulds typically cost upwards of €10k each. Timber moulds can only be used on average for 20 pours and are very time consuming to make. Once the dimensions of a piece changes, so too must the moulds. BPC provided a total 13,000 tonnes of precast concrete, consisting of over 3,000 separate pieces of precast, to Páirc Uí Chaoimh, of which there were 800 different sizes, necessitating the requirement for over 16 moulds.

On waste management walks prior to the project starting it was identified that some existing moulds could be used instead of commissioning new ones. It was also identified that if BPC moved away from standard practice and traditional methods – which were both costly and time consuming – and invested in new technology, it would reduce the number of moulds required from 16 to 4 and improve overall productivity.

BPC researched best practice options and invested in adjustable steel moulds with magnetic features which reduced the number of steel and wooden moulds required, saving the company over 3% of the project value on new moulds and almost the same again in workable hours. Reducing the number of moulds also meant that all production could be carried out in the one area closer to the batching plant and stock holding area – all of which provided further cost savings over the lifetime of the project. The moulds were also designed and/or modified to facilitate rapid de-moulding using the Lean practice of SMED (quick changeovers) modelled on techniques applied on Formula 1 Pit Stops.

Figure 4. New Adjustable Steel Moulds.

Process Mapping: BIM

The Lean team focused on the traditional 2D method of planning and process-mapped how a typical project runs from start to finish, highlighting inefficiencies and areas where errors were most likely to occur. The process mapping demonstrated from the outset that using the traditional 2D method was bound to create complexities and errors in the project. Hence the first decision taken was to move away from 2D and implement BIM instead.

Process Mapping: Product Moulds

The process mapping also highlighted the adverse cost and time implications of using timber moulds and purchasing new job-specific project moulds, and this led to these improvements and capital expenditure in adjustable magnetic moulds. The team also process-mapped an individual piece of precast and identified time inefficiencies throughout the manufacturing process. As a result, the team decided to condense the project to one manufacturing area within the production plant, and placed it close to the raw materials which were required continuously to ensure that time was saved.

Plan Do Check Act: Samples

During the process mapping the importance of creating master samples for Client approval was identified to reduce errors and ensure that both BPC and the Client were aligned. This resulted in master samples being created, stored, and used as a benchmark for all subsequent products in the project.

Plan Do Check Act: Trial Fittings

The process mapping also highlighted the importance of carrying out trial fittings in the manufacturing facility prior to mass production to ensure that all products would fit correctly when being erected on site. Trial fits are expensive, time consuming, and complicated as internally BPC doesn't have installation experience; however, the benefits of planning, manufacturing, checking, and carrying out the trial fits meant that the Client could verify the products, that potential issues were highlighted and then avoided in mass production, ultimately resulting in zero errors and ensuring RFT delivery on site.

5S

5S workplace organisation has been deployed across the site resulting in greatly enhanced safety through reduction of workplace risk, a better work environment for frontline staff, greater customer perception, greatly reduced employee search time for production supplies, and significant savings in employee walks for components and supplies not at point of use. Over 3,000 individual 5S improvements have been implemented across the site. Additionally, over 1,000 implemented ideas by frontline staff have been realised via the company's local visual idea

boards. The company runs monthly recognition raffles using company merchandise and gift vouchers to acknowledge staff achievements.

A3Problem Solving
Projects that are cross-functional and complex in nature are resolved using the systematic problem solving process known as "A3 Problem Solving". The company has a policy that all certified Lean Management White Belt (24 people), Yellow Belt (12 people), and Green Belt (1 Person) are continually active on various projects across the plant. Projects such as reducing concrete waste to landfill by 50% have had a very positive impact on cost and environment. The company uses the Hoshin Strategy Deployment process to track all active A3 projects monthly and tracks key performance indicators (KPIs) for the plant at this meeting – current KPIs measure safety, quality, cost, delivery, and employee engagement in relative real time and all are showing a positive trend towards world-class performance in their sector.

Figure 5. Finished Product in Place.

LEAN INITIATIVE IMPROVEMENTS & IMPACT

The benefits of using Lean and BIM have been to the forefront in the success of this project. It clearly demonstrated that this is the way forward in the construction sector. Early pre-planning and a Plan Do Check Act (PDCA) approach enabled us to eliminate sources of waste before work commenced. The implementation of BIM through Lean has also had a lasting effect on how large-scale projects are now managed. The benefits are obvious and proven, and the strategy is now employed on all suitable projects.

Value was added to this project in various forms, including:
- Quality increased.
- Safety improved.
- Processes refined and improved.
- Modern technology applied.
- Employees upskilled.
- Enhanced collaboration between stakeholders.
- Enabled innovative solutions for site installation.

Specific investment included:
- The Engineering team created the entire precast requirements for the structure in BIM.
- BPC made a capital investment in infrastructure by purchasing adjustable magnetic moulds.
- BPC carried out internal trial fittings.
- Master samples were manufactured for benchmarking.
- BPC condensed and enhanced its manufacturing area specific to this project.

Benefits from the Lean Initiative – Utilising BIM
- Project streamlining – Reduced people travel distance by 1,000km over the product duration through Lean Layout analysis and 5S Workplace Organisation.
- Gave all internal departments and the Client complete project visibility.
- Improved project management through weekly visual board stand-up meetings.
- Eliminated over-run and under-run of products – zero waste of over and under production waste.
- Reduced stock-holding times – Finished Goods Inventory never exceeded 10 days' supply.
- Aided in delivery logistics – precast units scheduled and loaded to suit installation precedence onsite.
- Ensured timely installation – product overrun was non-existent.
- Eliminated stock rejections – reject rate from project scrap achieved to a 4.5 Sigma Level of Quality.

Benefits from the Lean Initiative – Mould Efficiencies
- Eliminated time required for wooden mould construction.
- Cost savings were achieved by reducing the number of steel moulds from 16 to 4.
- Time savings were achieved with the new magnetic adjustable system.
- Reduced waste.

Some other initiative outcomes include:
- Increased benefits around Health and Safety – Winner of National Health & Safety Risk Management Best Precast Award Winner 2017.
- Reduction in site repairs and delays.
- Closer quality control resulted in no re-making of units.
- The production and installation programs were reduced to meet site needs.
- A 3% saving on pre-tender budget.
- Over 4,000 recorded improvements from frontline staff via the localised visual idea boards and 5S philosophy across the site.
- Supply chain cost savings of over €100k.