

COMPANY OVERVIEW



COMPANY WEBSITE

www.suireng.ie

Suir Engineering is an Electrical & Mechanical Services Provider. It was established in Ireland in 1984, and is part of the Imtech UK & Ireland group of companies that generates €400M in revenue annually. Suir Engineering's projected turnover in Ireland for 2018 is €130M. We have over 800 directly employed staff in Ireland, with a further 2,000 in the UK. We have

offices in Dublin, Waterford, London, and across the UK.

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OVERVIEW OF THE LEAN INITIATIVE

Since 2015, Suir Engineering has continuously increased its investment in its strategic and company-wide improvement initiative entitled "Suir Way". In 2015 Suir partnered with LCI to sponsor and organise an LCI Community Event entitled "Lean as Ideology & The Ability to Change". In 2016, a number of employees were supported on higher education programmes to Black Belt level competency in Lean management. Between 2017 and early 2018 Suir secured approval to undertake a 'Lean Transform' project supported by

Enterprise Ireland, and with the assistance of an external training partner Suir is presently experimenting with a new process for managing its projects as well as the overall business. This has necessitated a significant amount of both off-site and on-site training, and the company is now seeing some large step-change improvements on various pilot sites. This case study presents Lean Construction projects completed by several employees as part of their recent Black Belt projects.

BACKGROUND TO THE LEAN INITIATIVE

The construction sector has significant productivity issues, with several reports identifying substantial non-value-add (NVA) or "waste" in its processes. Suir Engineering, along with the wider construction sector, is currently facing the challenge of delivering projects on ever-tighter schedules and budgets. Clients, who themselves are increasingly familiar with Lean thinking and practices, are demanding that their contractors follow in the pursuit of waste reduction. Whilst concerns about the levels of waste in construction are nothing new, the destructive impact of the recent prolonged recession has made it clear that, even as the economy recovers and construction activity increases, business as usual is no longer acceptable in construction. Lean Construction offers opportunities that allow companies to thrive in any economic conditions, and Suir Engineering has made a strategic commitment to the adoption and implementation of Lean thinking and practices internally and on its capital projects.

This case details the improvements Suir Engineering has achieved by implementing Lean thinking and tools on the electrical installation component of the construction works associated with a significant extension of an Irish medical device facility, including the installation of two new manufacturing lines. The initiative included the implementation of waste walks, the 8 wastes (TIMWOODS), quality improvements, visual management, and 5S. This project illustrates how the implementation of Lean enabled Suir Engineering deliver this project on time,

on schedule, with notable improvements in our specific processes, and also evidence of improved quality and staff morale.

A new perspective has enabled us to see that there was a lot of waste in our processes on-site, including:

- Materials leftover after project completion.
- Materials damaged due to poor storage and excess ordering.
- Reworks due to poor coordination.
- Excessive snag/defect lists.
- Lack of planning.
- Inefficient workflow.
- Poor design.
- Inefficient processes.
- Overruns on project schedules and costs.
- Poor site layout.
- Inefficient plant and tools.

The Client ultimately absorbed these inefficiencies and wastes, and they also led to project cost escalation and project schedule overruns. As the Client is a manufacturing company fighting to maintain its market share, it has adopted Lean thinking and practices into its own core work environment with the aim of delivering added customer value. For this reason, the Client demanded that its contractors joined the effort to reduce waste everywhere. This aligned to Suir Engineering's own strategy, which has targeted quality improvements, productivity, and workflow as key to achieving sustainable competitive advantage.

LEAN INITIATIVE UNDERTAKEN – LEAN THINKING, TOOLS, TECHNIQUES

Ensuing from meetings with the site management, supervision, trades people, and a voice of customer session with the Client, the following process improvement areas were selected:

- Waste Walks; 8 Wastes; 5 Whys; Measurements.

- Work Standardisation.
- Information Centre Meetings using whiteboards.
- 5S and Visual Management.
- Quality Improvements and Snag Reductions.

Waste Identification and Elimination

Multiple posters were developed on the subject of Lean and continuous improvement to communicate our improvement intentions. One of these posters was on the subject of the 8 Wastes. A large proportion of inspections on construction sites are conducted through walks on the site by management. In addition to regular management walks, there are also, for example, safety walks, main contractor walks, and Client walks. A waste walk template was drafted, and we encouraged all supervisors to complete a waste walk sheet once they detected any waste. It was decided to implement weekly waste walks by the supervisors to ensure that their work processes and areas of responsibility were free from NVA activities. These waste walks were completed and documented via the waste walk sheets, which have since been replaced with a paperless audit sheet accessible on our online computer interface.

The supervisors developed several ways in which to make improvements to their particular areas of responsibility, including, for example, relocating the drawing table near the work area so that staff do not have to walk over and back to get information from drawings. From initiation of the waste walks, one of the largest examples of NVA activities discovered was the amount of time the tradesmen spent walking to and from the workshop and stores, and these trips represented a large barrier to the flow of the electrician (see Table1).

Table 1. Average trip time to stores and workshop

Trip number	Time in minutes and seconds
1	8.92
2	11.45
3	10.65
4	7.66
5	12.72
6	7.98
7	8.79
8	9.85
9	12.03
10	10.05
Average time per trip	10.01

Portable Workstation and Stores

As a construction project involves a high degree of variability from week-to-week, it was impossible to define an exact frequency of trips to the workshop and stores. It was more practical to conduct a series of observations and informal discussions to attain a fair estimation. It was found that 30% of the workforce visited the stores once per day, and 20% of the workforce visited three times per day. By getting an approximate average time value for a return trip to the stores, an overall potential cost to the project was calculated as €7,989.91. To counter this problem, a mobile workstation and 'job-box' chest of materials was procured and positioned where the work was being carried out. This workstation included a workbench, a portable chop saw among other tools, and a large steel chest where battery-powered equipment could be stored securely when not in use.



Figure 1. Material job-box and workbench set up close to work area.

Standardised Battery-powered Equipment

Another opportunity for improvement identified during the waste walks was in the use of corded power equipment on the site. In order to use a corded power tool in a work area, regulations require tradesmen to use 110-volt ("V") equipment. This necessitates time to survey the immediate vicinity to locate an available 110V transformer with a spare socket. Following this, the tradesman would need to acquire and safely trail a 110V extension lead to the area of their specific task. Through observation and interview, it was decided that 15 minutes was a fair reflection of time spent per day in acquiring 110V leads and equipment.

Planning and discussions with electricians and supervisors indicated that a good solution would be in the procurement of a standardised range of battery drills, jigsaws, grinders, and the like, where the batteries were interchangeable amongst them. This effort proved to have added bonuses, including:

- Using equipment that used the same chargers made finding the right battery or charging unit effortless or mistake-proof.
- Multi-bay chargers allow up to six batteries to charge at one time.
- No requirement to set up extension leads.
- Central charging point location cut down on walking time.

In addition to this new standardisation, it was discovered that a lot of waste emanated from other existing tooling on site. Further examples of new equipment procured in our drive to reduce and remove waste included:

- Diamond tipped chop saw:
 - o Extended lifetime of the chop-saw disc.
 - o Saves time walking to stores to use the existing static saw.
 - o Diamond tip is sparkless, thus increasing safety on site and negating the need for fire-watch personnel or hot works documentation.
 - o Clean cut, therefore no deburring required or filings.
- Pneumatic battery-powered hole punch for getting cables into panels:
 - o Negated the need to use hole saws that have a short usable lifespan.
 - o Hole saws were always used in the past to enable cable termination in panels. However, they produced a lot of metal swarf within the electrical panel, and not only did this swarf necessitate vacuum cleaning each time but there also remained a risk that lengths of swarf could bridge gaps between phases of electrical current, with the potential to cause great damage or death.
 - o Replacing hand stocks and dies with 110V version (no battery version available).

Information Centre Meetings

Daily huddle meetings were set-up and held at the start of each day's work. The huddle meetings gave an opportunity for two-way communications, facilitated problem solving, status updates, coordination, and a forum to discuss any potential issues. The huddle meetings promoted worker involvement and a culture of forward planning. The meetings were kept brief and to the point, and notes were taken and updated daily on a whiteboard. As part of the planning we held information centre meetings and updated a whiteboard with key information. The information centre meeting allowed us to plan our weekly work plan (WWP) and to focus on a six-week look-ahead (SWLA). Key project milestones were tracked, and this focused the group to plan any required safety method statements, materials, and manpower requirements.

5S & Visual Management

For substantial construction installations, most projects would have a designated storeman to help control inventory levels of equipment and accessories. Unfortunately, it is often

the case that stores are relatively disorganised, untidy, and laid-out with little scrutiny over the potential wastes of motion or waiting. This was the norm with the stores on this project until improvement initiatives were undertaken.

Because the stores were so disorganised, historically an electrician might opt to make the trip to the stores himself instead of sending the more cost-effective yet inexperienced apprentice. To eliminate the continuation of this practice it was deemed that the stores should be so clearly laid-out that the right equipment could be located in a much shorter timeframe. In order to redesign the stores, a combination of quantitative and qualitative research was undertaken to ascertain the most frequently required equipment. Then, by combining these efforts with 5S, a lot of wasted time was extracted from any given trip to the stores.

To address the problems, the following actions were taken:

- The storeman was given basic education on 5S and Continuous Improvement.
- The most frequently required items were moved to the front of the stores.
- Items that fell into a certain category of works were stored together.
- Shelving was labelled to reflect the appropriate category.
- Items were separated into containers and labelled by type and size.
- A large 2D drawing was created on CAD software to show the layout of the stores, clearly showing where everything is stored.
- A cleaning regime for the stores and work area was created, including the use of shadow board cleaning stations.
- A storeman completed an inventory list to track materials levels and prevent shortages.



Figure 2. 5S in stores – organised materials in a sensible way and labelled.

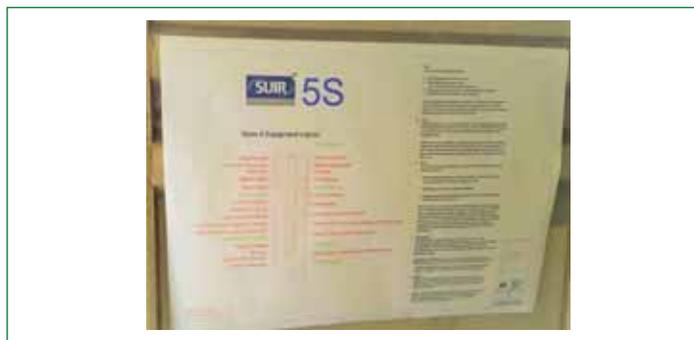


Figure 3. 5S in stores – reduce time looking for materials.

Quality Reward Scheme

Another action taken as part of this Lean project was the investment in a “Lean Quality Reward Scheme”. As research has shown, a higher quality installation from the beginning can lead to a significant reduction in snags, rework, and associated overheads. With this in mind, a relatively small quantity of resources was put towards communicating the benefits of quality across the project tradesmen. With the money allocated to the endeavour, a selection of tools and work equipment were purchased, and the scheme worked as follows:

1. When a member of supervisory staff witnessed exemplary high-quality work from a tradesman, they gave that person a ticket (with 5, 10, or 15 points written on it).
2. The tradesperson could save up these tickets to put towards a reward.
3. Towards the completion of the project these tickets were exchanged for tools.

Suir Engineering has developed and rewarded Lean thinking from the ground up. Using the TIMWOODS template for identifying waste, we encourage constant feedback on any waste identified on the project; and to further promote quality, the following were introduced:

- Visual SOPs (standard operating procedures) – these were placed where the work was being carried out.
- Quality Walks – we went to actively look for examples of good and bad quality.
- Recognition of good quality work at toolbox talks.
- Once a month quality demonstrations were held in the workshop.

LEAN INITIATIVE IMPROVEMENTS & IMPACT

Waste Identification and Elimination

Although the posters are educational, it has been shown in other cases that practical changes on site are far more effective than the use of posters. With continuous advocacy for the Lean journey, more supervisors and tradesmen felt empowered to highlight problems and suggest improvement ideas to management. As noted earlier, the amount of time spent travelling over and back to the stores equated to a project cost of €7,989.91. This does not even take into consideration the opportunity cost of this waste to the project. By reducing these 285.35 man-hours, the project schedule was easier to adhere to. After taking the cost of the equipment into consideration, the creation of the on-site work-shop and stores have saved the project a conservative €1,726.96. The use of standardised battery-powered equipment resulted in a financial saving for the project of €2,339.00. The overall success of the waste walk system has been profound. Along with the financial benefits, the effect it has had on the cultural side of the Lean journey is highly evident. The fact that the project management team are

avidly supporting the employees to make positive change, as well as “putting their money where their mouth is”, conveys a good message that is in line with the overall goals of the organisation.

5S & Visual Management

From qualitative feedback received from the tradesmen and supervisors, there have been striking improvements regarding the stores. Individual members of staff have reported saving half the time in finding equipment in the stores. It is difficult to truly measure how much time has been saved by completing this work, but even with the conservative estimate of just 5 minutes saved per man per day, the following savings were recognised:

- Number of days cumulatively worked by all tradesmen = 1,910 days.
- $1,910 \times 5 \text{ mins per day} = 9,550 \text{ mins} = 159 \text{ hours}$.
- $159 \text{ hours} \times \text{€}28 \text{ per hour} = \text{€}4,452 \text{ saved from the project}$.

Implementing Visual Management and 5S has had many

benefits for the site:

- Improved safety standards.
- Improved productivity.
- Improved quality.
- Improved working conditions and morale.
- Better use of storage space.
- Reduction in damage to stored materials.

Images of the newly improved stores, along with the CAD drawing, can now be shared with other project managers to learn and implement on other projects.

Quality Reward Scheme

The quality reward scheme significantly reduced snags and rework for this project. Figure 4 highlights the dramatic improvement in quality from 827 snags in the previous project (pre-Lean) to 286 on this project (with Lean).



Figure 4. Reduction of snags achieved by this project (bottom) Vs very similar previous project (top).

On average it takes at least 1 hour for a trade person to clear a snag. This substantial reduction in snag numbers led to a saving of 541 hours, which equated to a financial saving in the tens of thousands of euros. Although it is often said that you shouldn't reward someone for the job they are supposed to be doing, the realistic situation here was that we were spending very little money on tools that better equipped our employees with the overall aim of embedding inherent commitment towards high quality. It is important to mitigate against any habits of cutting corners or short-term orientation. The quality reward scheme promotes Lean thinking and contributes to the creation of a continuous improvement culture by engaging with the tradesmen. The Client and main contractor were very impressed with our efforts in improving quality, and this has helped us greatly in securing further projects.



Figure 5. Employees receiving their tool rewards.

Safety Improvements

During construction of the previous production lines, a weekly site audit was carried out by the site EHS team where findings were discussed with all contractors and arrangements made for items to be closed-out. This was then translated to the employees on the ground via weekly huddle meetings. Generally, the audit score for the site safety audit came in at 96%. During construction of these production lines, Visual Management and 5S were introduced to the site and they helped shape a better culture for managing and handling of materials on site from the site stores where all equipment and material was assigned specific locations. These have been labelled for easy retrieval by operatives on site, and this has in turn reduced housekeeping issues on site. An initiative entitled "The Drive for Five" was introduced and consisted of more than 200 separate audit aspects where each aspect had a nominal score value of 0 to 5. Achieving a 5 indicated an exceptional degree of preparation, administration, and execution. The site scored 5 in all audit aspects. Since the introduction of the above systems, the audit score for the project has improved to 98%.

Summary

Overall the project achieved savings of over €20,000 and had a productivity increase in terms of the S/E (Spent Vs. Earned) measurement from a loss making 1.10 to a more efficient 0.98. As can be seen from the results of the audits, project safety also improved and the project was completed without any lost-time accidents. Staff morale greatly improved on site, and management, supervision, and trades staff supported and collaborated on all Lean initiatives. Working conditions and general housekeeping improved greatly on the project. Because of a greater emphasis on short-term planning, we received positive feedback from our procurement office and suppliers. The company received very positive feedback from the Client, who was very pleased with this high-quality project delivered on time and on budget.

Recommendations:

- Education programme on Lean tools to be rolled-out across the company.
- Planned kaizen events to establish other areas that could benefit from Lean tools and thinking.
- Earlier engagement with future potential clients to establish other improvements areas.
- Carry out lessons-learned sessions periodically throughout the project to share knowledge and establish areas of concern that could benefit from Lean thinking.
- Create a focus on continuous improvements and maintain any gains achieved.

Some key initiative outcomes include:

- Improvement in trades productivity – S/E improved from 1.1 before to 0.98 after.
- Higher % achieved in weekly safety audits – from 96% before to 98% after.
- Reduction in project snag numbers – from 827 before to 286 after.
- Reduction in delays – over €20,000 worth of man-hours saved from initiatives.
- Project completed on schedule.
- Project completed within budget.
- Workforce educated through coaching and practical on-site delivery.