COMPANY OVERVIEW

COMPANY WEBSITE
www.mercuryeng.com

Mercury is an Irish-based European contractor. We build and manage complex engineering projects that reimagine how people work and live in the built environment. We believe that real innovation happens if you're willing to be brave. Our determination and sharp focus enable us to deliver leading-edge construction solutions across a range of key sectors including Data Centres, Healthcare, Life Sciences & Technology, Fire Protection, Building Services, and Technical Support Services, taking our clients to new territories they never thought possible. Mercury employs 2000 employees across Ireland, the UK and Europe and had an annual turnover of €770Million in 2018.

OVERVIEW & BACKGROUND TO THE LEAN INITIATIVE

AUTHORS


Shay Lacey


Jason Toomey

Mercury has long been an advocate of Lean and has been implementing its principles into work practices for many years. Lean has always been something we strive for and our default position is if there's an activity or a task that we're going to perform for our client, safely, we're always trying to make it happen better, faster, or smarter. We have a Lean programme at Mercury called "Leaders in Lean" where once a week a great idea from a construction site is shared across all our staff which comprises 2000 people spread out over 10 countries. Additionally, we've recently re-commenced our Yellow Belt programme and are currently in the process of implementing a Green Belt programme as part of our drive towards Kaizen or continuous improvement of our employees so as to ensure the maximum value is added within each and every one of our projects. Approximately one third of our people have been trained to date to either Yellow or Green Belt level.

LEAN INITIATIVE UNDERTAKEN – LEAN THINKING, TOOLS, TECHNIQUES

Value-added (VA) is the key phrase in this case study. We are aware that every day our objective is to complete our work with as much VA time as possible. For our trade operatives work crews, our goal is to add the maximum value to each project every day. Construction crews require a wide variety of different resources such as tools, machinery, etc., on a daily basis to execute works. If these resources can be identified and made available to trades at the start of each day, the likelihood is that non-value-added (NVA) time in the first hour of the working day can be greatly reduced. It has been measured within the industry that the first hour of the working day is by far the most likely to contain the greatest amount of NVA time.

The objective of this case study was to create a company-wide Standard Operating Procedure (SOP) that would help supervisors and foremen to plan the crews' works and the required resources ahead of time to ensure that Mercury would achieve more VA works within the first 15-minutes of every working day. This SOP aimed to result in an additional 4% of VA time to the working day. An additional 4% of VA time simply converts to an additional 4% profit on direct labour projects which naturally reinforces the business case for implementing this new process Group-wide across Mercury. Poor planning leads to poor performance, and naturally it is assumed that better planning will result in a better performance in terms of safety and quality, but also contribute to increased VA time across projects.

Running an efficient project should always make use of Lean Construction to reduce waste. Using the mnemonic "TIMWOOD" helps to identify waste. Identifying waste allows us to reduce our costs, increase profits, improve lead times and boost customer satisfaction. The easiest way to remember the seven wastes is to ask every day on site "Who is TIMWOOD?".

TIMWOOD:

- Transport: It was discovered that trades were spending too much time everyday walking to retrieve materials.
- Inventory: Pipe storage racks were loaded with materials that trades did not require on a given day, wasting valuable space.
- Motion: As per transport, there was too much time spent walking from work areas to retrieve information or drawings.
- Over-Production: Our off-site facility was delivering excess materials to what we needed for a given period.
- Over-Processing: Employees were spending too much time on getting information required from drawings – we required more clear and concise information for trades.
- Defects: Staff were having to re-work elements of works due to them not being done right first time (this can be attributed to the lack of required information mentioned previously in Over-Processing).

Using TIMWOOD, our team was able to identify the waste and inefficiencies that we needed to address to increase VA time. In addition to using TIMWOOD to identify waste, Mercury has implemented a variety of Lean project management tools in order to increase efficiency and improve VA time across projects, including DMAIC, PDCA, LPS, and 5S.

The PDCA Cycle (Plan, Do, Check, Act)

This PDCA cycle gave our supervisors the appropriate

structure to address the issues noted from their direct observations:

- Plan: Day 1 – Supervisor spends one hour each evening planning the works for their crew.
- Do: Day 2 – Supervisor utilises their general operatives to obtain the resources required by trades to complete their daily tasks.
- Check: Day 2 – Supervisor completes 'Daily Huddle' to inform crew of planned works for next day and check that all the required information and resources are available.
- Act: Day 3 – Crew complete works with VA time within 15-minutes of start.

Last Planner® System (LPS)

The foreman and supervisor complete a 10-minute huddle at the end of each working day to discuss:

- What their team needs to plan to complete tomorrow.
- Establish what resources are pre-planned and available.
- What was completed that day.

5S

The foremen worked with their general operatives to properly sort the pipe spools that were required for trades to install the planned works on the next day. Pipe racks were labelled with shelf numbers, for example Pipe X is now stored on Pipe Rack Shelf No.1. All waste pipe or materials (if any) were removed from the pipe rack and work area. This process became standardised within the work crew and was then subsequently shared with other crews. The process became a habit and now continues to be utilised on a daily basis. The process was initially piloted with one supervisor/foreman, with the supervisor then educating their team on the process and keeping them updating on its ongoing benefits. Trades staff noted the benefits to supervisors at daily huddles as they found it easier to execute their works. The process was then rolled out to the other supervisors/foreman in the group who again took their trades through the learning process and benefits. As the new processes were introduced to other groups, more supervisors/foremen and trades become involved.

The team involved in this case study who planned, refined, and implemented the project comprised the:

- Project Manager.
- Site Supervisor.
- Site Foremen.
- Site Trades.

Define, Measure, Analyse, Improve, Control (DMAIC)

This project identified that every trade on the construction site could be losing 30-minutes of VA time at the start of each working day (at a conservative estimate). Due to the daily start up nature of the works, it had never previously been considered that the entire time could be recovered. With VA within the first 15-minutes being the target, and in making allowances for the time spent by foremen and general operatives' pre-planning works, the target set an additional 4% VA time per day per crew member.

The existing process was measured using data from the ongoing Direct Observations (DO). Figure 1 shows a typical example of a measured activity. The VA time across the day was extremely low with a total 9% VA time (equalling only about 5.4-minutes of actual productivity within the first hour). Upon further investigation, we discovered that retrieval of materials, set-up, consulting diagrams, and moving totalled 43% of the time and as such were particularly applicable with regard to the first hour of daily activity.

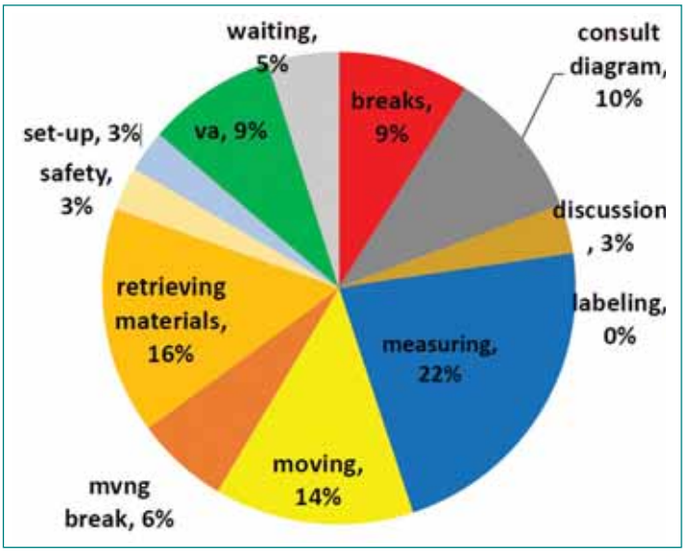

Figure 1. Direct Observations A

LEAN INITIATIVE IMPROVEMENTS & IMPACT

The process was piloted in one group ("Group 1") which consisted of approximately one third of the overall project. The process was developed and refined with one specific supervisor who had bought-in to the process from the outset. The supervisor added to the process by implementing 5S principles with regard to the sorting and labelling of resources (in this case Pipe Racks) to enable trades to become more efficient. With some work and weekly reviewing of direct observation data to emphasise wins, we implemented the process with the other supervision members in Group 1. Supervisors bought into the process, and with this we had achieved our first major win.

The Project Director noted the results that were achieved from the process and focused on the DO results. After reviewing the DO results for Group 2 (see the key observations below), the Project Director insisted that the process now be implemented for Group 2.

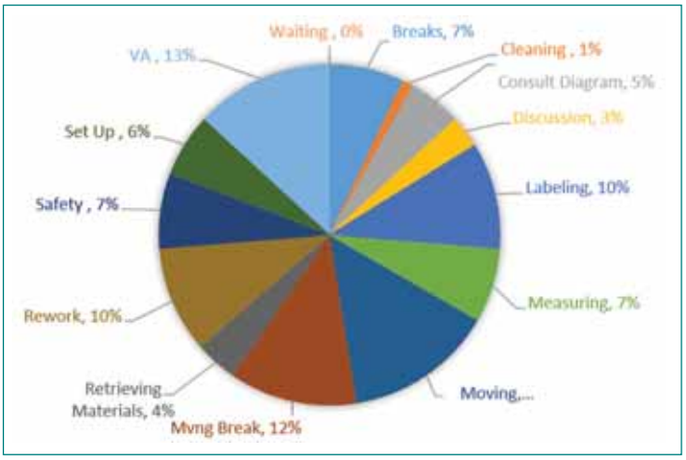

Figure 2. Direct Observations B

Group 2's Key Observations of the Working Day

- 14% of the time (2-hours 26-minutes) was spent moving at the start of shifts, breaks and mid-shifts between the sub-work area and the main work area to rework the maintenance panel, retrieve labels, and fabricate a spool in the sub-work area (1-hour 50-minutes). Moving around the spool in the work area under the floor and in the adjoining chase to measure/assess (22-minutes). Remainder of moving due to moving with tools, moving to stores, and BIM.
- 10% of the time (1-hour 43-minutes) was spent reworking to remove the gauges and conduct fitting from the maintenance panel and refitting of the same incorrect order as well as the drilling two holes in the maintenance panel. This time also includes leaving the main work area to complete this in the other level.
- 10% of the time was spent labelling the spools under the floor in the work area. Again, this factors in leaving the work area in order to retrieve labels and writing the specific lines from LSP to ID labels upon return to the work area.
- 7% of the time (1-hour 8-minutes) was spent measuring. This time was spent checking and verifying HP pipes for the exact location and alignment, checking and verifying the work was completed and also measuring for the installation of the maintenance panel.
- 8% of the time (45-minutes) was spent retrieving materials. This consisted of retrieving spools and ID selection from the rack (14-minutes). The remainder of time retravel materials was due to retrieving fittings, cushie clamps, clutters and facing tools.
- 6% set up (1-hour) due to assisting the welder to set up purge lines from workplace level (47-minutes). The remainder was due to removing tape from spools (10-minutes).
- VA time (13%) – HP SS Pipe installed & maintenance panel on the pillar.

Recommendations

- 10% rework on bought in items – need to investigate why gauges and fittings need to be altered on this and if all tool requirements are different.
- Moving between different levels for labels and reworks – consider if the labels could be kitted for the crew and left in the pass-through to avoid having to leave the work area.

The DO in Figure 2 illustrates a poor VA at 13%, and highlights the areas that were addressed throughout this case study. Group 2 will implement the process over the next period, and despite some early scepticism there is overall confidence that the process will result in a performance improvement. We are now intending to move the process to Group 3, and we intend to move the process to a new project that has just began using direct labour trades. It is imperative that Senior Management buy into the process before this happens and for it to be documented as a Supervision SOP. Once written formally as an SOP, it will make the process much easier to implement on future projects.

The team involved learned and demonstrated their learnings from the project initiation to completion. We soon learned that if a productivity problem exists, it cannot be fixed by simply brainstorming and implementing the fix via "who shouts the loudest". The DMAIC process proved to be effective in systematically working through any processes to improve the current situation. We also now have the learning of a kaizen approach and how we can implement this process with regard to any future challenges we may face.

In the construction industry generally, and particularly during this case study, we have found that if we can remove the obstacles and waste to allow trades to have good cellular flow (trades often speak about having a "good run at the work"), productivity will see significant improvements. The fact that supervisors along with much of our trades had been introduced to Lean Construction through a Yellow Belt process was beneficial as they gained an understanding of what VA or NVA work actually was and why there was a need for Mercury to address it.

Moving forward, we need to continue to utilise the tools and processes we have learned. The smaller and relatively simpler elements such as the 5S process is now embedded into our company-wide site procedures and will be of major benefit in the long-term. From a management point of view, we now have a process for evaluating, diagnosing, and improving those project productivity items that have a commercial impact on project success.