

Ardmac is an international construction specialist delivering complex and high-value workspaces and technical environments. Headquartered in Dublin, and with offices in Manchester, Craigavon, and Brussels, Ardmac employs over 300 people and provides specialist services to the commercial fit-out, life sciences, and data centre sectors.

Ardmac's vision is to be "the contractor of choice for clients, and the workplace of choice for great people". Ardmac's mission is "to consistently provide the ultimate solution for high value working environments through continuous investment in the best people, technology, and processes".

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Overview & Background to the Lean Initiative

Ardmac began its Lean journey in 2015 through client demand and implemented the Last Planner® System (LPS) in response to this client demand. After the successes of the LPS as its first Lean initiative, Ardmac has strived to bring Lean to the forefront of all activities across the entire business. In February 2019, Ardmac started to integrate its Field Management System (FMS) for use across all projects. That was another progression along Ardmac's Lean journey as it allowed the management of all phases and aspects of projects, from pre-development and bidding to project completion.

The latest progression in Ardmac's Lean journey is using Quick Response (QR) codes to store all information on each individual room in one single location on its FMS. This initiative started on one of our current projects for our Client, WuXi Biologics in Dundalk. Encompassing 13,000 sq.m., this project comprises the construction of multiple cleanroom systems, including walk-on-ceilings, modular partitions, lights, terminal filter housings, floor finishes, doors with door automation, and installation of downflow booths.

Lean Initiative Undertaken – Lean Thinking, Tools, Techniques

This case describes the project information storage practices and procedures prior to and following Lean implementation, an overview of Ardmac's FMS, and the approach to implementing the use of QR codes as a pilot initiative on the WuXi Biologics project.

Traditional Project Information Procedure and Storage Method

Before Ardmac's adoption of its FMS, we relied upon completing handwritten inspections, quality walks, safety walks on the site, and then going back to the office to scan, email, and upload all the information to the relevant parties. It was difficult to keep record of all information and it was a very time-consuming activity which led Ardmac to take the decision to implement its FMS as part of this Lean initiative.

Overview of the Field Management System

There are currently several FMS available in the construction sector. Ardmac's FMS allows us to manage all phases and aspects of projects, from pre-development and bidding to project completion. The FMS streamlines construction management in many ways, from easy document searches to automated delivery of documents and revisions to team members. The software maintains daily logs, progress reports, drawings, requests for information (RFI), schedules, specifications, submittals, and timecards. It also supports integrations with quality and safety software, and provides field productivity management tools and construction financials. It also enables team members to use these features on any of their devices, wherever they are located and in real time.

How Locations Work in the FMS

In our FMS, when one creates an observation, issues a submittal, or undergoes a quality inspection, that process can be assigned to a location to make that information more relevant. When a room is inspected, you want to have that location information included in that process so that other users can see where inspections have been completed and the photos you take can be associated with that location for future reference. A user can search a location which will display all the inspections, observations, RFIs, and so on, that have been linked to that location/room. From this, a detailed report of any location can be generated which will show all of the historical data and provide a timeline of events for that room.

The Obstacles with the FMS Locations Pre-QR Codes

The locations feature in the FMS is very beneficial; however, it does have a significant obstacle, namely the users. For example, person A might go into room 1001 on level 1 in building D, and complete an inspection and name the location "Building D > Level 1 > Room 1001" which is perfectly fine. The problem then is that person B might go into that same room and complete a separate observation and name the location "Building D > L1 > R1001". The problem with this is that, even though it is the same room and both ways of naming that room are perfectly fine in and of themselves, the FMS does not recognise that location/room as being the same location. The issue with this is that when other users search this location, they may only get the information that person B created depending on how the user searches for the information. If they search R1001, this will automatically rule out finding person A's information on this location simply because it does not match with Room 1001. This makes information hard to find it is very time consuming to gather a report trying to match up two different locations even though both users completed their respective inspections/observations correctly. Another obstacle that can be found on larger projects mainly, is that there are so many rooms you do not know what room you are in and therefore have to search through drawings and look at gridlines to determine where you are before even creating the inspection/observation.

Linking QR Codes to the FMS

The way to overcome the obstacles with locations is to generate QR codes. Ardmac's FMS has a feature that allows a QR code to be generated in its software for each location. The QR code can then be printed and placed into that location. Now when Person A goes into Building D > L1 > R 1001 the first thing they do is scan that QR code that is placed in the room with their tablet or phone. When the person scans the QR code, all of the information that is associated with that location is now visible to them on the device, like, for example, punches, observations, and inspections, and you also know exactly what room you are in without having to look through drawings. Now they can see if an inspection has been completed in that room and they don't double-up on the work and do the same inspection

that has already been completed. They may want to then create an observation and it will automatically link it to that room. Now when person B goes into that room, they follow the same process and scan the QR code and they can see that an inspection and observation has been completed in that room.

Before QR Codes Were Implemented

Figure 1 illustrates how the same room can have two different names and therefore represent a doubling-up of the same inspection. However, if the QR code is scanned then the person doing the inspection would have seen what inspections had already been completed or were open for them to continue with. The only difference in the name used is that the second location has DK2 in front of it. Even though both are the same location out on the site, the FMS recognises this as being two different locations.

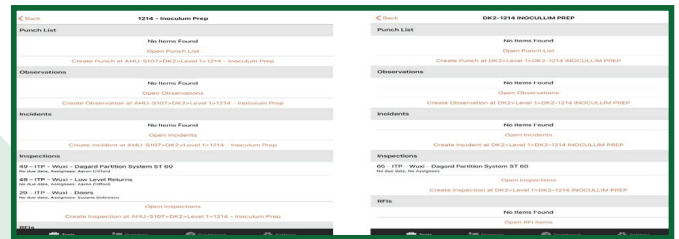


Figure 1. Example of Inspection Report Duplication

Using QR Codes in the Field

The process is to simply generate the QR Code for each location within the FMS admin page, print off the sticker and place it in the room with which it is associated.



Figure 2. QR Codes Placed in Each Room

When you enter that room on site, you scan the QR Code within the FMS app which will take you directly to the information on that room.



Figure 3. Post-QR Code Scan – all room information is in a single location

Lean Initiative Improvements & Impact

The key benefits arising from using QR codes in the FMS on this project include:

- Information on a room is now stored in a single location on the FMS servers rather than doubling-up the information by calling the same room two different names.
- Users can simply scan the QR code and see what room they are in and what has been completed in that room, thus making the inspection process much more efficient.
- Time spent searching through documents to see if you or someone else has already completed a task in that room is now eliminated simply by scanning the code and you can see instantly what you are looking for.
- Generating an end report on each location is simplified and you can be sure that all the information on that location is in the report without spending hours looking through each document to make sure you have what you need.
- Documentation for turnover packs are easily accessible – now it is simple to select the rooms you are handing over and the FMS will generate the documentation for the rooms selected.
- The documentation as a whole is cohesive, accurate, and relevant to each individual location across the project.
- Performance data is now captured in real time on all projects, which gives clients great insights into potential issues and thus the ability to focus on proactive rather than reactive analysis.

The ease at which handover information can be generated is a key benefit of managing project data digitally. All information in models and field management software is tagged based on location, system, and package. Thus allowing the extraction of information such as submittals, inspections, punch lists, drawings, and schedules based on handover sequence and the creation of handover packs. This is especially useful on complex technical projects where handover is typically based on a building utility system-by-system approach.

On site is where most of the benefits of this technology implementation are realised. Efficiencies are greatly improved by removing the need for walking to and from the site office for information by adding the ability to complete safety and quality inspections on mobile devices and by tracking the key project metrics such as open RFIs, overdue snags, and outstanding submittals. Communication among all project teams has become streamlined. Each of the tools on the platform manage a specific part of the project.

All data is controlled via role-based permissions, and this ensures data privacy is guaranteed for all collaboration partners. All project drawings are uploaded on the platform, and there is then an ability to overlay RFIs, inspections, photos, and other items and pin to the relevant locations on the drawings.

Further Improvements to Come in the FMS

Ardmac is now working on assigning labour costs to locations using the QR codes. This will work by management scanning the QR code for a location and then assigning the labour hours and task for the operatives working in that location on that day. This will provide us with a labour report throughout the project, which will show where improvements can be made, where particular locations giving us problems, and the productivity levels of each crew.