

The Benefits of Utilizing QR Codes on Construction Jobsites to Conduct Punch

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Abstract

The punch process of construction is an important task that a construction project team is faced with before a project reaches final completion. A punch list documents and tracks items that need to be corrected, repaired, or are incomplete. If not closely managed, open punch items can drag out the completion of a project, and is often seen as a tedious task for project engineers. The industry has not seen much change as to how this process is conducted until recent advancements in construction software. This paper will take a deeper look into the benefits seen from utilizing Procore's location-based quick response (QR) codes to manage punch lists. Through interviews with employees of a well-established general contractor, it is evident that using QR codes can greatly benefit all key players involved in a construction project. Using QR codes to create punch lists enhances efficiency by streamlining data communication onto one platform that can be accessed by all of the players involved. It allows for general contractors to get ahead on pre-punch items, makes the punch walk more efficient, and allows for that information to be easily documented and accessed by subcontractors who will be completing the work.

Keywords: Streamline, Project Management, Efficiency, QR Codes, Punch Lists

Introduction

The construction industry has been slow to adopt new technology until the recent development of new software designed to improve collaboration and project management between general contractors, owners, architects, and subcontractors (Busta, 2016). A particularly popular and innovative software in the construction industry that will be expanded on throughout this paper is Procore. This software houses numerous project management tools in an easily accessible repository, allowing the project engineers and managers to access crucial information for the project at their fingertips (Gerardi, 2019). In the repository, applications needed to complete job-crucial tasks are linked together and easily created, edited, and distributed, allowing workers to efficiently complete plans, requests for information (RFI's), submittals, and change orders. While it has

already been named a top choice for major construction companies to utilize for increased project efficiency (Gerardi, 2019), it is still fairly new and continues to develop new features not yet leveraged by its users. One of these features to the author was able to explore during an internship is the Quick Response (QR) Code feature for locations in the building. This paper will expand on how QR codes can be utilized to streamline the punch process on a construction project.

Literature Review

What are Punch Lists?

A punch list is a document created during the closeout portion of a construction project which lists any work that is defective, missing, or not completed (Ramos, 2020). The goal of the punch list is to ensure the quality and completion of construction to the specifications set in the contract. “All work that does not conform to the specification of the contract should be included on the punch list” (Benarroche, 2021). Once these defects are documented, the list is then distributed to the various responsible subcontractors for them to come back and complete the necessary work; this is known as backpunch. (Kim et al, 2019).

Closing Out A Project

Closing out a project entails completing all necessary work required by the contract and handing over the finished building to the owner in order to receive final payment. One of the main pieces in project closeout is completing the punch list. “The main focus of punch is to achieve the contractually agreed upon performance within the period stipulated for the construction project” (Szabo, 2018). In most construction contracts it is agreed upon that the last payment, known as retention, is withheld until the punch list is complete. A thorough and complete punch list is one of the key elements to a project reaching final completion on schedule (Carson et al, YEAR).

It is oftentimes very chaotic when it comes time to punch out a project. Punch tends to get overlooked by the project team at the beginning of the project and this results in scheduling difficulties down the road when it is time to complete punch for final completion (Carson et al, 2009). This often results in punch taking a lot longer than expected, “Although the amount of work left to perform after Substantial Completion is a small portion of the overall contract work (usually less than 1% of the contract value), completing the punch list often takes a disproportionately long period of time” (Rogers, 2012).

Keys to Successful Punch

While the closing phases of each project each present their own challenges, preparing and executing an accurate punch list helps keep everyone on track as the project comes to a close. Punch items can be difficult to anticipate and define in a contract so it is important to make sure that subcontractors are prepared for this. “The 3 keys to this are communicate, document, and educate” (Benarroche, 2021).

Maintaining strong communication with subcontractors and documenting work that needs to be done is crucial to the success of closing out punch lists. It is important to understand that the subcontractors’ end goal is final completion too and communicating work that needs to be done is imperative in meeting the goal of final completion for both parties.

Executing punch lists with Procore's QR codes solves both of these issues because the platform allows for documents to be shared over the cloud in real time. "QR codes excel at connecting people to information, and construction has many cases for that" (Koenen). QR codes are a very efficient way to track and share information which makes them a great tool for completing punch lists. The next section of the paper will explain how Procore's location-based QR codes can be used to manage and execute a successful punch process.

Background

As a project nears completion it is imperative to make sure to stay up to date with punch lists and when managers do not organize, track, and manage them, the project drags on. However, Procore's QR codes revolutionize this once painful process by quickly and simply generating QR codes, mitigating the risk of forgetting or losing information. The codes are generated in a few simple steps. To get started, one goes to the locations tab in Procore and it will give you an option to print QR codes that are linked to each location template that has already been created for the project. These QR codes are then posted to their correct locations in the building by a member of the project team, typically the project or field engineer. Once in place, they can then be scanned at any time by members of the project team, including subcontractors, and it will bring them to the action items for that room or location in Procore. From there, they have the option to add observation items as well as look at the items that are currently open in that room.



Figure 1: Example of a Procore location QR code that is pasted on the walls of the building for punch.

Once the actual punch walk comes along the process is made very simple for the project engineer when walking with the owner and/or architect. They simply walk into a room while on the punch walk and scan the QR code with a mobile device. The code then takes them to the punch list tab for that room and when they are walking that room and find a punch item that needs to be corrected they click on “create punch item”. This then allows them to name the punch item, take a photo of it, write a description, and then assign it to a subcontractor or responsible party.



Figure 2: Example of what comes up when you scan a QR code in the building

Once they have filled out this information for that punch item, they simply click create; it is then stored in Procore as a punch item for that location and is automatically distributed to the assigned subcontractor. Once the subcontractors are assigned they will be sent an auto-generated email from Procore notifying them that they are responsible for a new punch item. They can then click on the link from Procore and it will take them to a list of all the open punch items they are responsible for. On the other end, when the subcontractor foreperson shows up to complete open punch items, they should have a list on Procore of all the items that need to be completed for their specific trade. To make sure they are in the right spot for a punch item they can scan the QR code and it will show them any open items in that room.

Methodology

In order to determine how the use of QR codes is most beneficial, a qualitative data analysis approach was taken in the form of an introductory case study. The data for the study was collected

via semi-structured interviews. The study consisted of 2 interviews with employees from a reputable Bay Area general contractor. Each interviewee had experience with the QR code punch system and used it on multiple projects. To ensure diversity in the responses it was made sure that each interviewee had used the QR codes on different job sites. The interviewees were a project engineer and senior project engineer. A semi-structured interview approach was used in order to allow interviewees to take the conversation in the direction that they wanted. This allowed them to share their experiences in the way that they saw most beneficial. The interviews were recorded and electronically transcribed in order to document the interviewees' responses. The open-ended questions that served as the structure for the interview are shown below.

- What do you see the greatest benefits being in implementing QR codes for these tasks?
- What did the use of the QR codes allow you to do more effectively than traditional verbal communication?
- How did using the QR codes enhance the coordination and communication aspects of completing that task?
- Did using the QR codes help save time in completing these tasks?
- Are there any specific coordination aspects to the QR codes that may not be able to be as easily communicated without the use of QR codes?
- Do you have any specific examples of something that can be done with QR codes that may not be able to be done with the same degree of effectiveness when not using them?
- Are there any negatives to using the QR codes for these tasks?
- Is this something that can be easily implemented?
- Would you recommend the use of QR codes on future projects?
- Are there any types of projects where it is not worth the hassle of implementing the QR codes?
- Do you see this system taking off and becoming more widely used on construction sites in the future?

Analysis

Allows for Active Pre-Punch

The punch process is something that starts well before the official punch walk with the owner and/or architect. To get ahead of the future punch list and minimize the number of items that will be needed to be corrected after the punch walk, observation and pre-punch items should be tracked by the project team. Utilizing QR codes to track these items can be very beneficial for project engineers. With the QR codes in place, any time a project engineer is walking the site and notices something that catches their eye they can scan the QR code and add it as an observation item, work to complete item, or pre-punch item. If they are actively noting these items as they arise, they are getting a head start on future punch items that may arise on the official punch walk. Correspondent 1 sees the QR codes as a very effective way to get ahead on pre-punch. He stated, "It is a very beneficial tool for getting ahead of items that will come up later during punch. I walk the job multiple times a day for various reasons and at any time during one of my walks if something catches my eye that is damaged, incomplete, or installed incorrectly I will scan the QR code in that room and add it as an observation or punch list item". This allows for project engineers or project managers to actively add to their pre-punch list while they are on-site completing other tasks. There is no need to complete a full internal pre-punch walk because, in theory, most of these items have already been caught and the responsible subcontractors are notified of the changes that need to be made. So, when the time

comes around to do the official punch walk with the architect, there will be a substantially more manageable number of items needed to be fixed.

Streamlined Information for Backpunch

According to correspondent 2, one of the hardest parts of the punch process is coordinating with the subcontractors and notifying them of the finishing touches they need to complete to finish out their scope. The traditional method of punch involves walking the building with the owner or architect, writing down the punch items that they point out, and taking photos of them. This information is then typically put in a spreadsheet by the project engineer and sent out to the various trade partners. While this seems fairly straightforward there is still room for error as the project engineer may not take detailed photos or notes and may lose some of that information when transferring the punch list notes they took in the field to the project management system. With this process, there is a lot of room for information to be lost whether it be from the architect to the project engineer, the project engineer to the subcontractor project manager, or from the subcontractor project manager to his foreman. With the QR codes, all of these potential issues are eliminated because the list is being created in real-time as the walk is being conducted.

The greatest benefit to utilizing QR codes for this task is that it streamlines all of this information onto one platform that can be accessed by all of the key players involved. Correspondent 1 stated, “It helps in adding clarity and making sure that something is communicated holistically to a trade partner”. Once the punch item is added to the QR code on the punch walk, that information is then relayed directly to the responsible subcontractor. This takes out the factor of the project engineer missing any information that the architect notes on the punch walk and that information not getting properly relayed to the proper subcontractor.

MY OPEN ITEMS

	Item Type	Details	Status	Due Date
✧	Punchlist Item	#16: Baseboard Paint Touch Up	Pending	11/25/21
✧	Punchlist Item	#17: Caulking Missing / Damage	Pending	11/25/21
✧	Punchlist Item	#18: Drywall Patch	Pending	11/25/21

Figure 3: Example of the list of open items that the subcontractor will see on his end

Correspondent 1 stated, “While it is great to have face-to-face conversations, you also don’t want to get into a situation where you tell a foreman something and he tells someone else who then tells a laborer to do it and then all of the sudden you get the wrong lighting controls”. A big benefit to the QR code system is that it handles this issue of miscommunication or lack of communication from the subcontractor’s foreperson to their crew who will be on site performing the work.

Correspondent 1 explained that “A big benefit to it is just having it be accessible to everyone on a project because a lot of the time you will have a foreman receiving it [the punch list], but by the time you are getting later into closing punch items you are not going to have a full crew out there. So it is an easier way to have that information already located in a place that can be accessed by anyone in that company”. Anyone on site can simply scan the QR code in the room that they will be doing work in and it will give them a list of all of the open punch items that his trade is responsible for in that room. It will also show them the picture of the item in question so they have a detailed reference of what exactly needs to be completed. Having the picture included “ensures that the

clarity of the message is getting across [to the subcontractors]”. This ensures that they are maximizing their efficiency while on site by not missing any items and having to return another day. This limits the headache of the project engineer having to reach out to that trade partner again to get them back on site another day for one little thing that they missed while completing their punch list.

Saves Time and Eliminates Miscommunication

When asked what he believed was the greatest benefit to using QR codes for completing punch, Correspondent 2 responded with one word: efficiency. With the QR code system, all items can be added to the punch list while on the walk and there is no need to input them into Procore afterward. This process can be tedious as there may be many punch items to add as well as many photos to sift through and link to each correct punch item. Correspondent 2 believes the time-saving aspect to be a very significant benefit of this system, stating that, “It makes it so much faster to make because all you need to do is scan the QR code once and then you can start adding punch items. You just click to add an item, take a photo, save, add an item, save, add an item, save, and then go to the next room and repeat the process with that QR code”. By doing it this way, the full punch list can be created and distributed while on the walk without any extra steps taken after the walk is completed. This makes the process very efficient for everyone involved and is repeated for every punch item pointed out in the room without the need to scan the QR code each time to add an item. The value of the automated process transcends to the architects as they appreciate the ease of the QR code. Correspondent 2 added that, “Architects appreciate it because it is a more streamlined way to create punch items”.

Downsides to Utilizing QR Codes

The company observed in this study has been using using this system for a year now and has implemented it on a few of their projects; it has been a great success. They have noticed some minimal downsides to implementing this system but, the both interviewees stated the benefits greatly outweigh the negatives. The only true hassle with using the QR codes is the extra work required initially when creating and posting the QR codes. Correspondent 1 ran into some trouble with this when his project was the first to utilize this system by their company. Since the project had been going on for multiple years with many different project managers and engineers, the team had created many different name formats for different locations in the building. For example, one project engineer had already created a location for room 186, calling it “186 Womens Bathroom”, but another project engineer down the road created another name for the same location calling it “186 womens bathroom”. Because the “Women’s Bathroom” was not capitalized in the second project engineer’s entry it created a different location tab in Procore for the same building. Because of this, Respondent 1 had to combine all of the similar locations in the building before he could print the QR codes for that room so that they were all linked back to the same locations tab in Procore. This, however, could have been avoided had the project engineers on the project using the same locations tab that already existed instead of creating new templates when creating RFI’s, submittals, markups, or observation items. This falls on project startup and the initial work done by the project engineer at the beginning of the project. If the project engineer went through the project early on and created templates for each room in the building with the same naming structure then the other project engineers and managers could just use those existing location templates without the need to create new ones that were duplicates of the existing ones. Other than that the only upfront work with rolling out this system is printing the QR codes and taping them to the walls of their designated locations in the building.

The only other potential problem identified with this system was working with older subcontractors who are not fully adept at using new technology. They may not understand how QR codes work and they may need to be shown how to scan the QR code and access the data. This, however, is not a significant issue and can be easily mitigated by giving them a brief tutorial of how the system works.

Conclusion

The Future of QR Codes for Punch

Conducting punch lists with Procore's QR code system that has been described in this paper has proven beneficial by one contractor. After utilizing the QR code system on 3 projects, one interview respondent said that he will continue to push for this way of conducting punch to be utilized on future projects that he works on. When asked what types of projects this system is best suited for he said, "There is no real limit to it, I have used it on 6 million dollar jobs as well as 600 million dollar jobs and I have seen the same benefits.". This shows that job size may not play a factor when using this system and it can be applied to jobs of any size. The use of the QR codes on previous projects has shown to be very successful for this company and they will continue to use this system on future projects.

For this company, the application of QR codes has resulted in a significant benefit in fast-tracking the punch process. It has allowed for the project team to get a head start on pre-punch, speed up punch walks, and more efficiently communicate what needs to be completed on back punch. This is a very viable option to enhance the punch process that can easily be implemented on any jobsite that is using Procore. There is however limitation to this project as it is an exploratory case study that is limited to one contractor and a small number of their projects. Future studies should expand on this to determine if the experiences described in this paper are consistent with other builders.

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