PORTAL PROJECT

DEFOE CONSTRUCTION

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Prepared By:

Nicholas Sansone, Daniel Leal, Samuel Whitaker

Executive Summary

The purpose of this proposal is to integrate a full suite ERP for Defoe Construction LLC. DFL is known as a subcontractor for many projects in the tri-state area and has worked with some of the largest and most reputable general contractors like Tishman's Hudson Yards plans. DFL has several specialized employees ranging from carpenters, electrical engineers, to general laborers and each carry with them special budgeting and financing. Since some groups are headed by a union, budgets become harder to manage as more senior members who get paid more need to be prioritized for jobs. For other groups they don't have unions, but OSHA guidelines require more investment for workplace safety.

As DFL provides construction services they need to be able to accurately forecast delays and money shortfalls that could delay production schedules. For example, the pandemic, while a very unusual case, forced DFL to request an additional $25M for an initial $160M to work on LaGuardia Airport changes. Being able leverage historical data, invoices, production schedules, and budget sheets would improve insights for future projects.

Another function would be to increase transparency for general contractors and their architects who oversee a job yard. Understanding just where they are in the process and ensuring that all steps were followed to the exact specifications of the architect are crucial to avoid delays and potential safety issues down the line. Furthermore, allowing the general contractor to see in a timelier manner just how much over time and delays are eating into the wage budget would avoid unwanted surprises further down the line.

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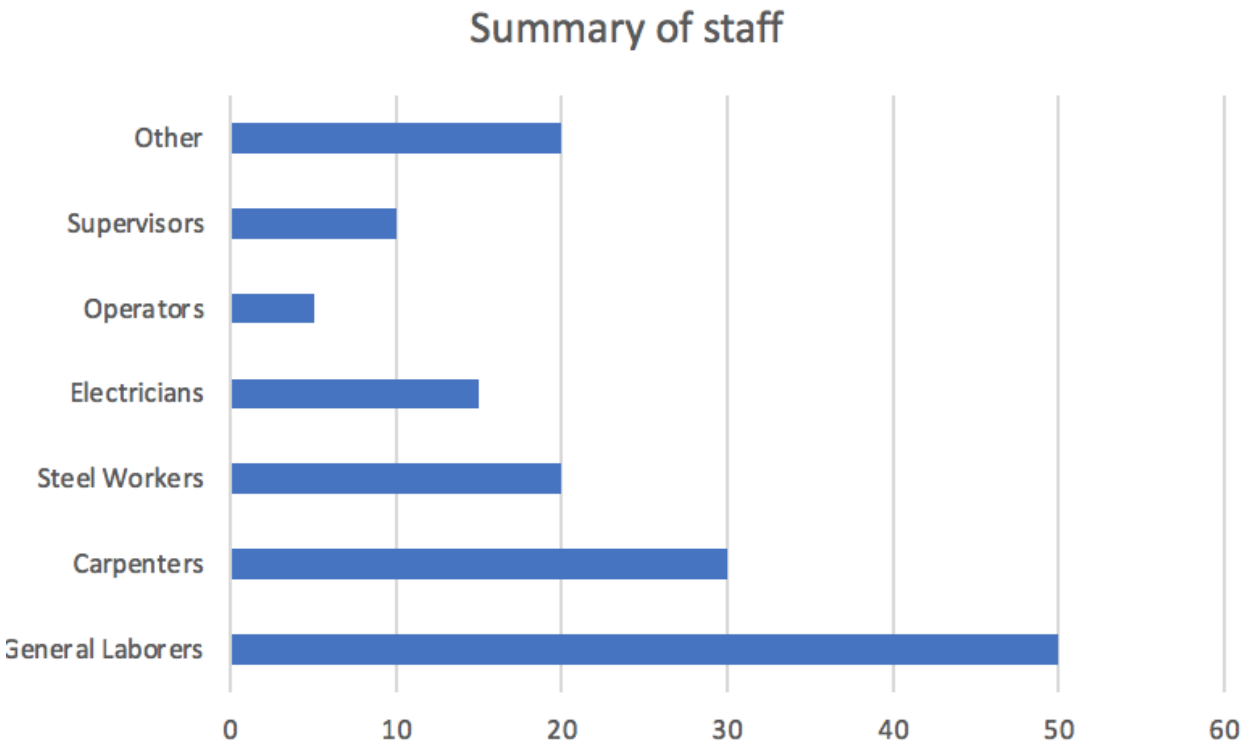
Executive Summary

Introduction

What is Defoe's main business?

Defoe is a sub-contractor that works on projects primarily in the NYC and tri-state area. We are subbed out by larger construction companies that are general contractors on jobs, to perform a number of different tasks ranging but not limited to pavement, steel structuring, and industrial carpentry. We have engineers, carpenters, electricians, and general laborers on staff and for special projects, we may source and supply highly technical specialists as well.

All of these projects come with budgeting, timeline, financing implications, insurance needs, etc.



Do they all work in an operations capacity?

Our business has a wide variety of people working for it. We have office-staff that manage the planning aspects of the job, assigning people to sites and making sure that our jobs are staffed up. We have finance and accounting professionals that are handling billing and paying for materials, settling up with GCs, etc.

We have project managers that are on the site coordinating the efforts on the grounds to make sure that we satisfy the project and the customer is happy. We also have laborers and skilled

workers who are performing the work. All of these people hold a role in delivering an on-time project for the customer.

You mentioned general contractors, does your job require you to share project-related information with them daily?

Contractually, we are required to provide regular updates on our work to our general contractors. Additionally, we want to keep them informed of our progress since they are our customers and we aim to keep them happy. This is where a lot of the problem is, this step of communicating with contractors is a time-intensive process.

Construction work is highly field-oriented, so it is often very difficult to get a hold of people. When on-site, many people will not answer their phones. They work early mornings and are often done by 3pm. In a lot of cases, the administrative aspects of the work gets offloaded to a clerk in their office.

When we are trying to communicate project status, budget questions/adjustments, project change orders, etc, this process is highly antiquated and takes way longer than it needs to. Often, we spend a week getting in touch with decision makers at the GC and executing. GCs are dealing with multiple sub-contractors so their time is spread thin.

Other subs have portal systems that their GC's can log into, that show status of project, reflect any change orders and request digital signatures, etc. These subs end up winning a lot of bids for jobs, since this portal supports on-time delivery of projects and satisfied customers.

(Organizational background, known business issues/problems, system objective, scope)

Requirements gathering

When determining what was essential to the website we organized the firms requirements on a priority schedule as shown below.

Facilitate budget request	**Need**
Assign workers to jobs	**Need**
Assign Budgets to jobs	**Need**
Inventory forecast	**Want**
Budget forecast	**Want**
Read only access	**Good to have**

Who else needs to have access to this information?

Internally:

Everyone in our office needs to have access to this. Administrative staff that do staff-planning, billing, communication with customer, need access to this information real-time to work with GC admins. Our executives need access to this information when they have higher-level conversations with their clients.

Our sales teams need this information when they are bidding on other jobs with similar GCs – its important for them to know where current projects stand and use that data to influence new business decisions.

Our HR teams need to know when/how staffing is happening so we can anticipate when we will need more workers and start sourcing them appropriately.

Our Project Managers need to be able to update this information on their own to provide real-time feedback to HQ and client. Additionally, PMs need to be able to input change order requests and see their statuses, so on-site they can begin executing changes once customer has agreed to them.

Externally:

Externally, we need to provide access to this system to our customers, GCs that have subbed us out. If we could integrate into their project-management software, that would be even better. I don't know the name of the one they use generally off the top of my head, but I will get it to you.

If customers can access this information themselves, we can send push notifications when updates have been made, and we will spend less time tracking them down and more time winning new business.

When it comes to change orders, it would be helpful if other agencies involved in the project (architects, etc) had access too. Often a change needs to be approved by not only the GC, but other subcontractors. This system would allow us to source all of those signatures in one place, everyone logs in, the information is all there, and we don't need to email it or pass it around in snail mail form.

Do your internal systems currently support widespread access to accurate information related to projects?

Currently, we maintain this information in a bunch of different systems. We just started using an online tool for staffing projects – it is helping us be more efficient with that part of the business.

We use excel to manage budgets and P/L for most of the projects – its just what people here are comfortable with. We use Excel to track the cost of materials. Our planning teams need to send information to our materials teams (via Excel) daily to make sure materials orders adequate products. Often this information is wrong and the delays derive from there being no product on site.

When it comes to change orders, we currently have to prepare all of the paperwork, deliver it to the PM for the GC, and wait sometimes weeks to get countersigned documentation. This process is done entirely on paper and is very inefficient.

What are some examples of issues that this lack of widespread information has caused?

- Overbudget on projects because cannot accurately track cost of materials in real time

- Delay to projects because approvals/changes need extensive info-gathering/validating before decisions can be made

- Delays to projects because materials do not arrive on time

- Reporting misinformation on job completion statuses to clients

- Double-booking skilled workers

- Unhappy customer because they think the work has been completed, but really they received bad information

- Inefficient hiring processes because HR and staffing have no access to job details

- Currently not nimble enough to adjust resources in the event of a storm, bad weather, etc. We need to be able to adjust project timelines based on work we anticipate not doing too.

So, sounds like Defoe needs a portal of some sort that pulls data from sources and displays it for various stakeholders?

I'm not sure if it would be better to create an entirely new system for everything, or link together new and existing systems to try to develop faster. In general we need a master system that all of the stakeholders of our business can access, that carries real-time data.

If we had a system like this in place, we could operate jobs quicker and more efficiently, and we could scale up into a higher volume of jobs. Currently, we feel like we're kind of under water, and the only way to try to make our operation more efficient is by adding more people, which you know, is expensive and not always more efficient.

What would be the best way to interact with this application?

In the field, most people use smartphones or laptops, so a mobile application would be helpful. If it is run through a web-browser, that would also be suitable since you can process that through your phone and laptop.

Our experience from the interview:

The interview shed light on the impact that a lack of system is having on this business. We believe that the business will experience a large efficiency boost when they implement a system like this.

Our sponsor's role is not directly in IT, so it is challenging to understand all of the existing systems and what/how they would integrate with one another. Given our discussions, it will be impossible for our team to connect with IT, so we will have to operate on some assumptions (we will discuss in design).

Additionally, we have concerns about a widespread system with uniform access, as many users don't need access to certain portions of data provided. IE – does someone in finance really need access to HR data? We will need to consider these governance attributes in our build.

Use case diagram and detailed case description

Part II: Software Requirements Specification:

The purpose of this document and project is to build an online "master" system to manage all data regarding staffing, managing budget and P/L, tracking cost of materials, change orders, and additional job details for all projects that are in deployment. This system will be transparent on all ends so that users are able to see what is going on with projects using real-time data.

The scope of this project is to incorporate all of these aspects into an interface accessible either through a web browser or mobile application. This application is based on a relational database existing on the company's own private server so that those without access cannot find a way into the system. This ensures data security, as well as integrity; privileges are allocated based on the type of user so that access is limited to different departments in order to avoid change redundancies. At a high level, we hope to create a user interface that will optimize the companies efficiency and make everyone's lives easier through transpare

System requirements

Use cases:

Use case 1	Assigning staffing duties
Actor	Planning team
Basic Flow	When a new job opens up, workers must be assigned. The planning team uses this system to allocate workers to different job

	sites, depending on data regarding their availability. After assigning workers to the new project, their availability gets updated within the database.

Use case 2	Tracking cost of materials
Actor	Budgeting team
Basic Flow	When new materials are ordered to a job site, the cost is entered into the database to be viewed by the budgeting team. As these materials are updated in real time, there is no delay in the transfer of information and therefore allow them to be more efficient.

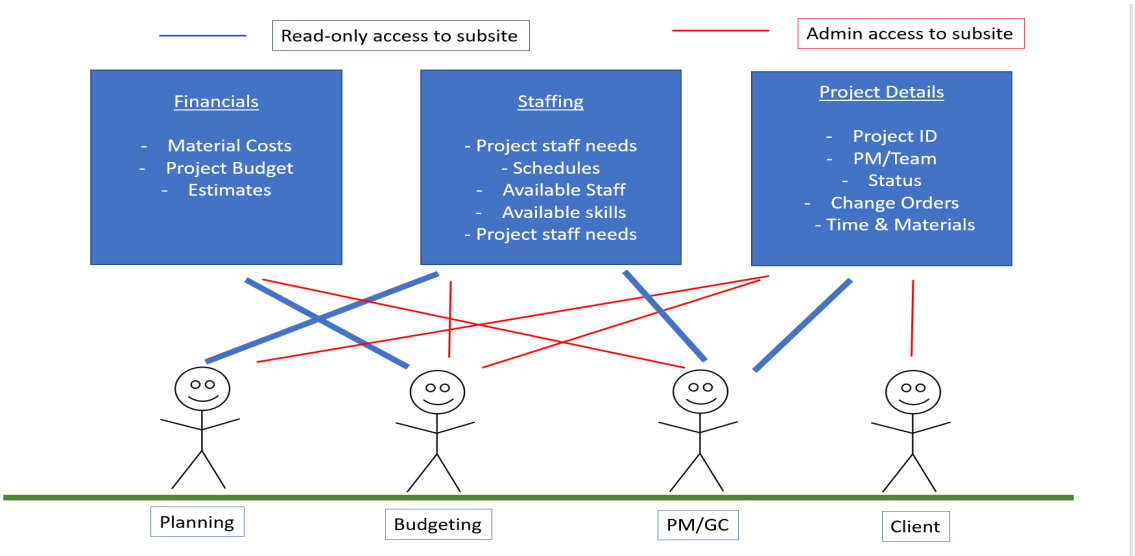
Use case 3	Change orders
Actor	The PM and GC
Basic Flow	When there is a change order that needs to be signed off, the request is sent to both the PM and GC for their approval/digital signature. Immediately after both users approve, the request is then sent to be countersigned through the application. This is a lot more efficient than sending the orders by paper and through the mail, saving both time and money on all ends.

Part 1. High-Level System Functions and UI:

Use Case Description:

Stakeholder	Key Use Case
Planning Team	: Allocate and assign specific workers to a given job : Monitor and augment staff on projects based on status of project, required skills, etc. : Ensure accurate information on hours worked, jobs
Budgeting Team	: Maintain cost information in system for time & materials ordered for jobs : Update and notify client of changes, request permissions to move forward with purchases directly in the system
Project Management/General Contractor	: Update daily progress of all tasks associated with job : Maintain updated estimates for completion of plan : Change order management & approvals : Send notifications in the system to clients and other parts of team requesting staff, approvals on materials, and progress reports
Clients	: Monitor project status and change requests through portal : Send messages to stakeholders within job chain as needed

Use Case Diagram:



Non-functional requirements

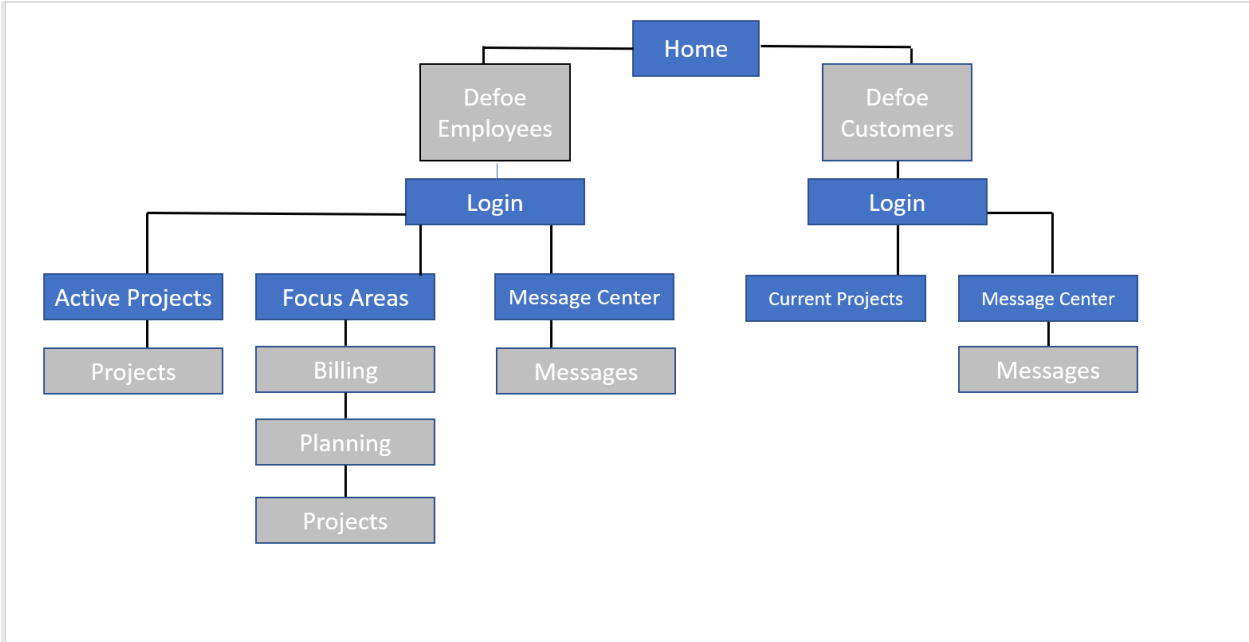
Use case 1	Access Security
Actor	Administrator
Basic Flow	Employees are required to use dual factor authentication or change their password the next time they log in within a given time frame. Users must set up dual authentication and change password upon first login. Employees cannot bypass additional budget requests without approval from those defined with such access. Access permissions including read only access can only be changed by the system's administrator.

Use case 2	Confidentiality
Actor	Security/Software Group
Basic Flow	The system will transmit records/receipts only when submitted and confirmed via dual authentication. Only internal auditors with correct authorization can view budget/expenses outside of project managers. The system will protect the privacy of all employee wages, salary, marital status and gender with regards to wage/budget allocation.

Use case 3	Efficiency and latency
Actor	OS
Basic Flow	Software will preserve 20 percent of the processor capacity and storage space. The system will be able to process notifications/requests within 2 seconds and up to 300 notifications in 10 minutes. The system will have the bandwidth to

	simultaneously process 300 users requests within peak times. Complete summaries of current day's approvals and requests shall be available within 1 minute of close of business at 5PM EST. The system shall produce a storage capacity warning notification when the 50% capacity threshold is crossed and each 10% increment following.

Page Map:



UI Examples:

Master Portal

User - Admin

Defoe Employees

Defoe Clients

Master Portal

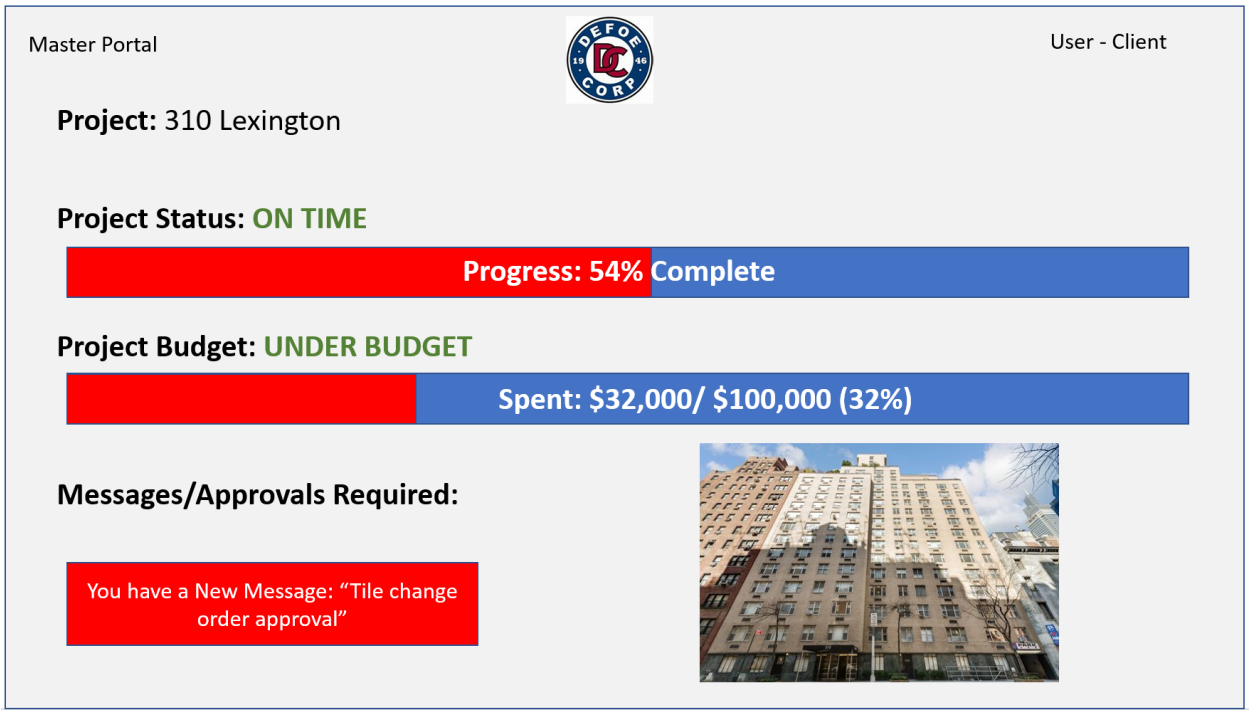
User - Admin

Welcome, Defoe Employee!

Active Projects

Focus Areas

Message Center



System Interface and updates to network/infrastructure design:

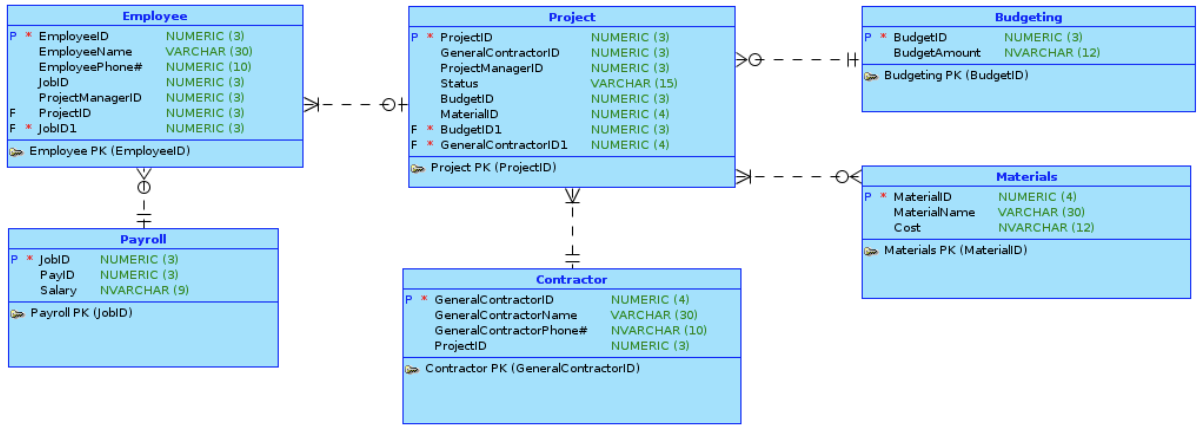
Access: Construction is a remote-driven field; our customers (both on Defoe and client side) need to be able to access this portal we are building from anywhere. Our design takes into account the need to view on mobile devices. This will likely be delivered through a mobile browser first, later to be developed into a custom mobile application.

Cloud Based: Defoe is in the construction business, not the IT business. For this reason, we are planning to design and host this application on cloud infrastructure. This will operationalize the infrastructure cost for Defoe, and ensure reliable access for their users and customers to support quick information. Additionally, it will free up Defoe resources from managing IT environments to client/project supporting roles. We have not yet selected a cloud vendor for this pursuit.

Database Considerations: Stewardship of customer information is paramount, and we are dedicated to protecting and allowing best access to the data behind this application. We are evaluating the idea of open source db offerings (like Postgres) as well as some vendor-supplied cloud-based databases to find the best fit for this project.

Part 2. Data Model:

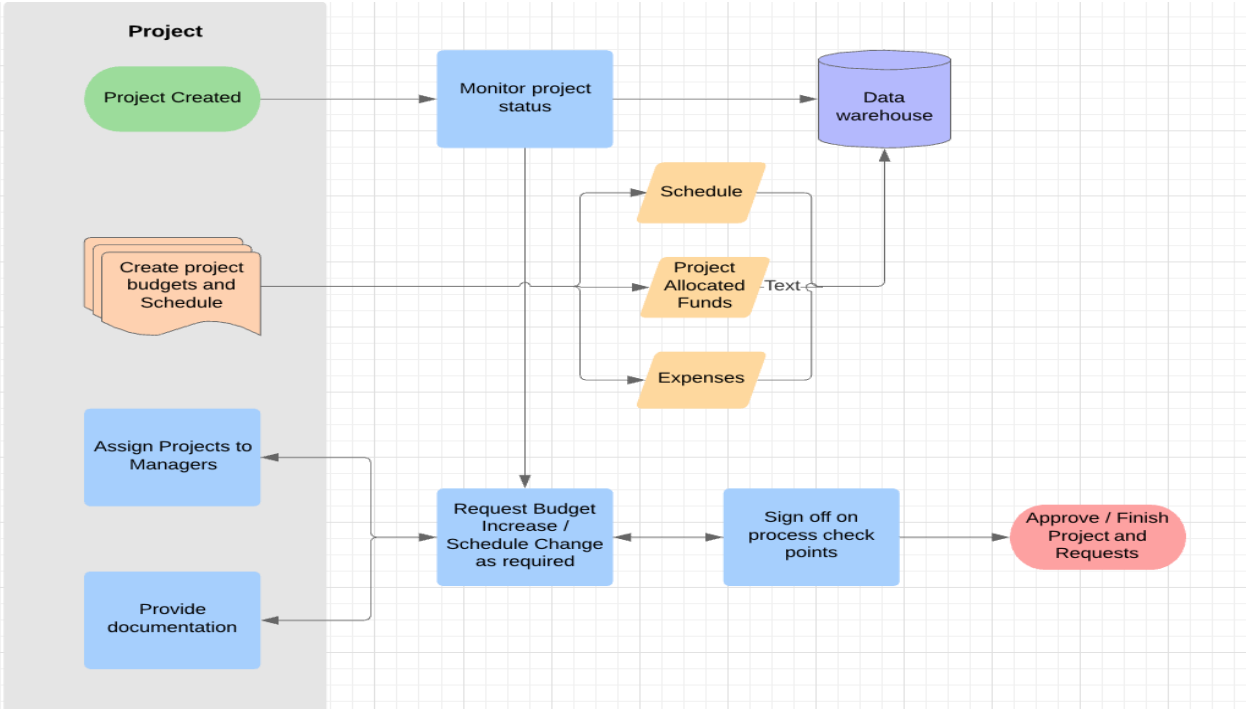
Entity-Relationship Diagram:



The above diagram encapsulates both the entities and their relationships, and the data dictionary. Entities exist as the blue boxes with the name in bold blue text- what follows underneath are the data components and descriptions of their data types and sizes. Relationships between entities are depicted by the lines between entities; within this diagram, there are one to many and many to many relationships. Within these relationships, primary and foreign keys play a large role to ensure data integrity. Within the entities, primary keys are illustrated at the bottom of the rectangle next to a key visual, and foreign keys exist with an “F” next to them.

Some known business constraints that exist within the database include the inability to establish a general contractor for a project unless that GC has been input into the Contractor table; this ensures that there are no insertion anomalies. Other constraints of the same function include the inability to input an employee’s role (JobID) until that role has been created within the payroll table with an accompanying salary, the inability to enter a budget for a given project until that budget amount has been entered in the Budgeting table, and the inability to enter materials for a given project until that material has been created with an accompanying cost within the Materials table. All of these constraints work towards ensuring that insertion anomalies cannot exist.

Part 3. Process Model



The above diagram illustrates the process workflow for stakeholders using the interface. Properly organizing where project managers are able to make requests related to projects and also the final sign off for each individual project needed to be carefully designed. As such during the monitoring project status the workflow allows users to request budgets adjustments and provide the necessary documentation. We also illustrate the initial touch point when the project is created and how it flows into the production schedule, project funds, and related expenses such as labor hours and materials. These all flow back to the data warehouse.

Third Party Solution: Procore

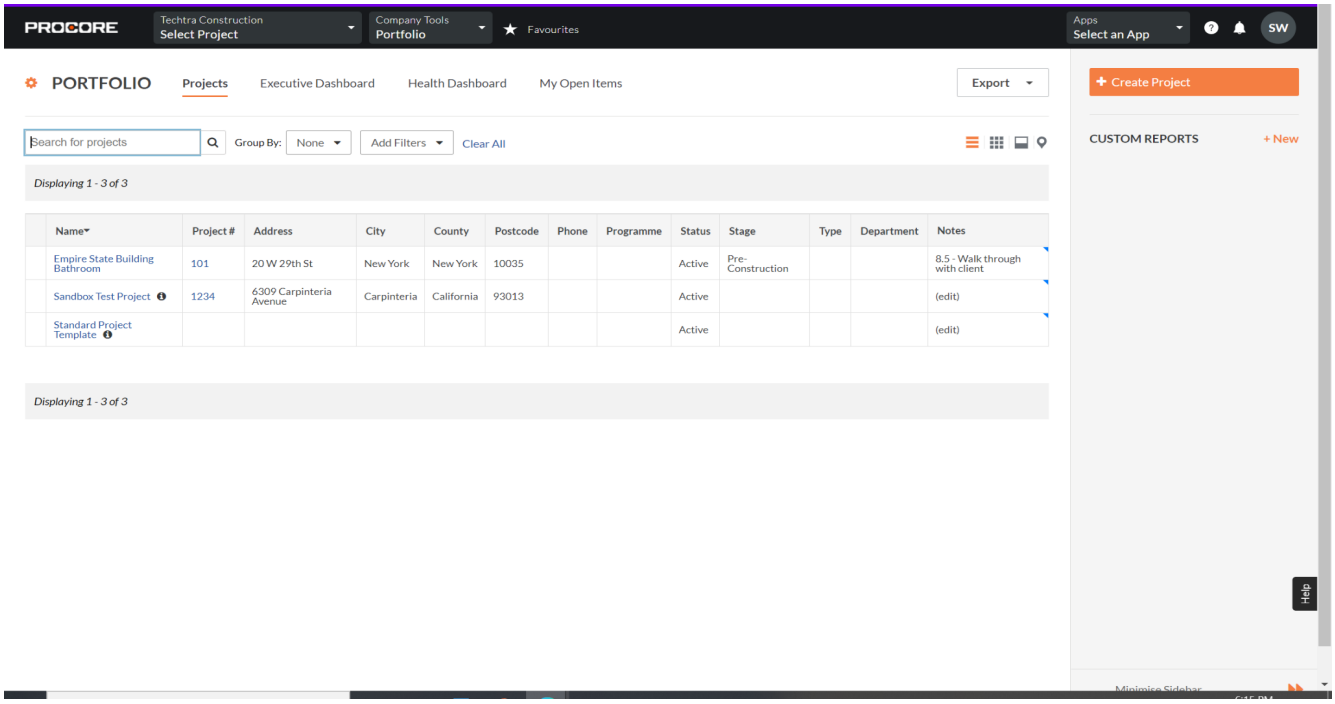
As part of our analysis, the team explored off-the-shelf software options that are readily available in the marketplace to satisfy the needs of Defoe. After extensive research, we found a possible candidate for the job.

Procore is a software development company that has created a Construction Management platform that is designed to “break down communication silos from precon to closeout so you can build less risk and better profits.” In consideration of Defoe’s needs, a platform that serves as a repository for all information, incorporates governance that allows specific users access to specific “slices” of this information, this option meets the need and is worth consideration. Adopting this platform would bring

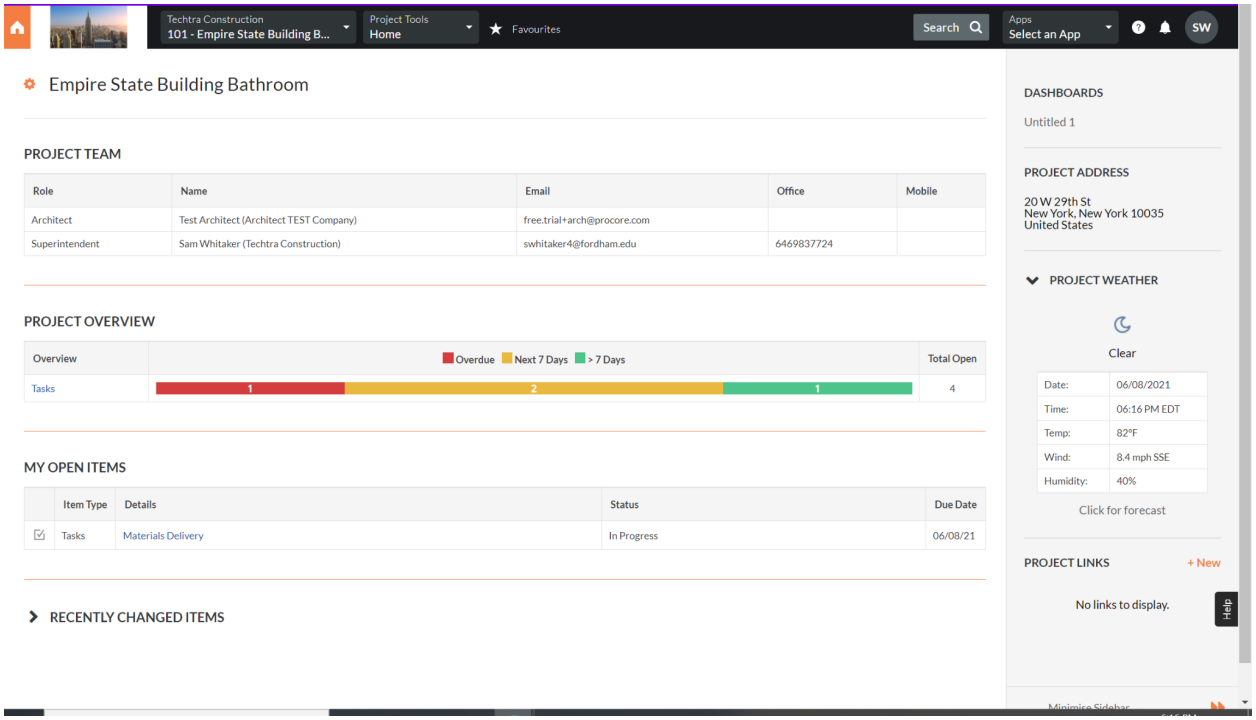
the functionality to Defoe much quicker, as the implementation could happen in a matter of days or even hours.

As you will see in these images (and our demo in the presentation), we could set Defoe employees and their stakeholders up on this site by identifying a handful of administrators within Defoe to set up the initial project details/tasks/milestones into the platform. Select users will have access to this homepage that lists all of the projects in the pipeline, including subsequent details about project progress, materials and labor needed, and more. All documents related to this project can be stored in the site as well.

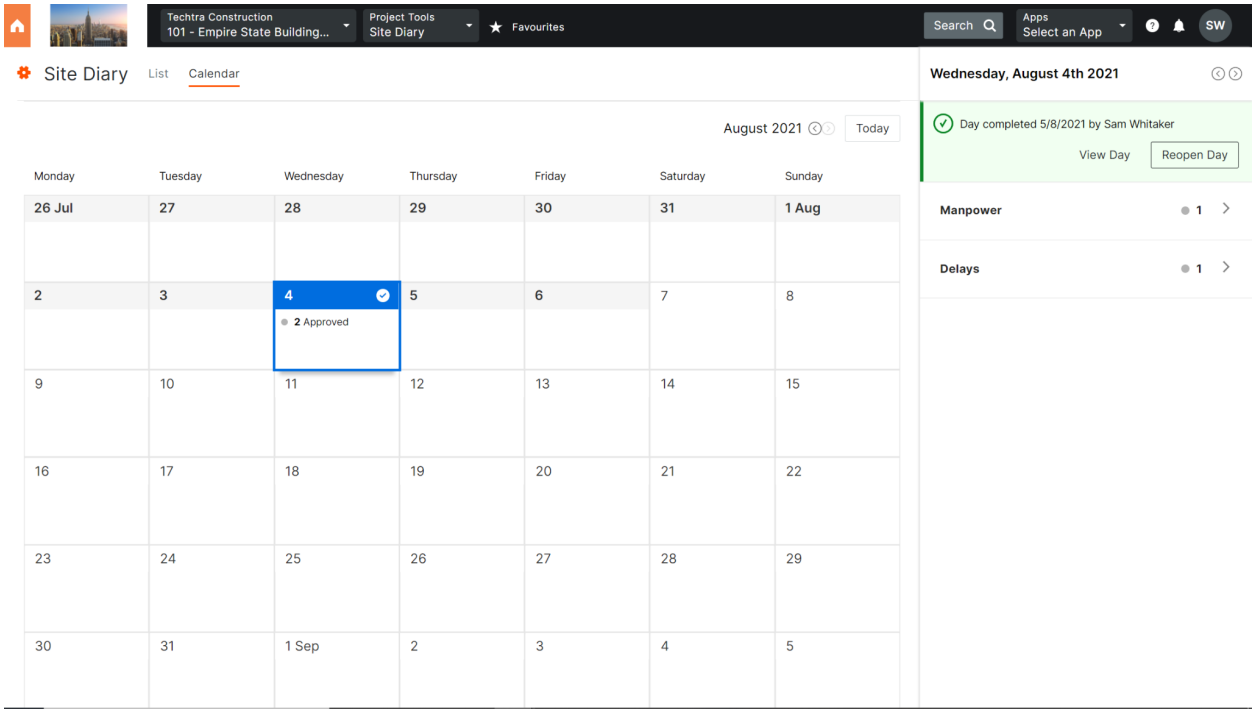
Home Page:



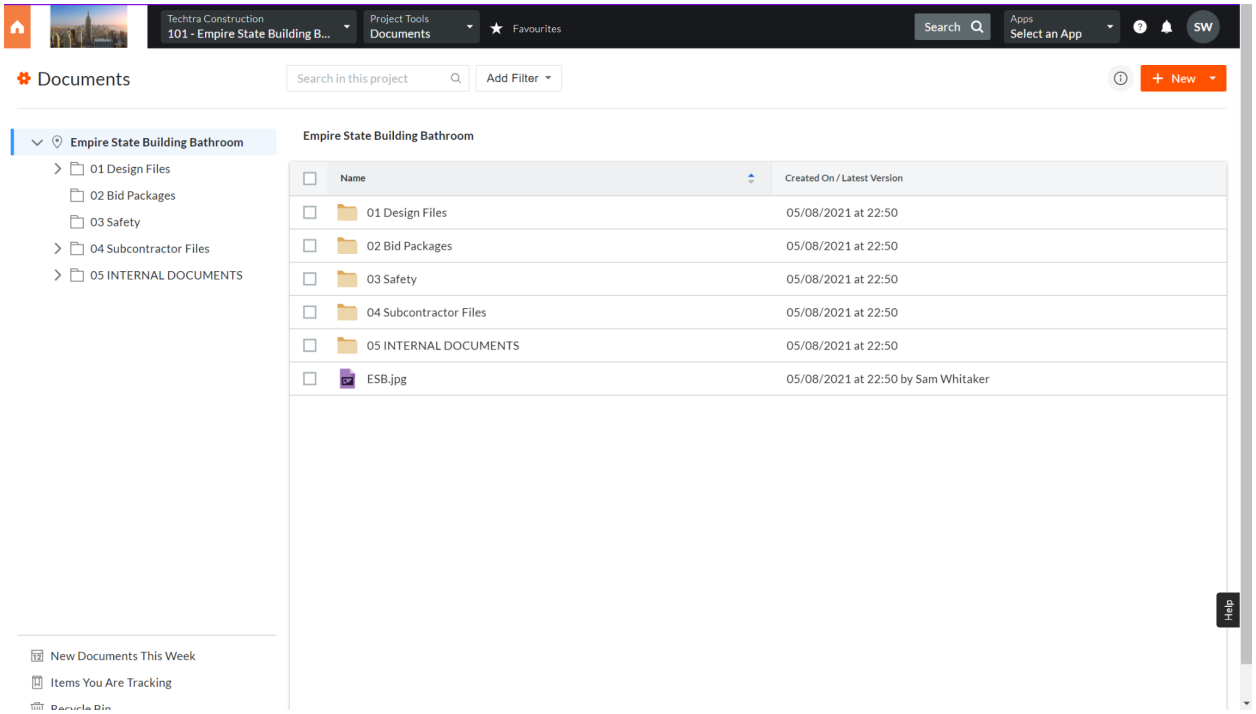
Project Page:



Diary (Calendar) Function:



Document Storage:



The diary function provides a concise calendar view of everything that has taken place related to the project in a given day, and acts as a virtual “bulletin board” for critical information.

We see clear of benefits to this option:

- Quicker implementation - site up and running in matter of hours or days
- Completely Managed Service (SaaS) - Defoe doesn’t have to manage databases, servers, or any infrastructure associated with this system. Simply pay the monthly fee and upgrade periodically to add capacity.
- Low-code option - Lesser reliance on resources who have coding experience to make changes/updates (which can improve experience in real time).
- Easy to use interface, support of Procore corporation for assistance needed.
- Unlimited users - Procore will increase infrastructure with added use so that your application performance is always strong.
- Mobile app - pre-built mobile application satisfies on-the-go users in the field.

Some notable drawbacks of this option:

- Limited customization - in our discovery period, we identified interest in customized dashboards and reports - something that Procore has on the roadmap but the functionality is limited now.

- Integrations into existing ERP/data sources unclear - Procore is cloud-based and might present limitations to integrating data from other sources around the organization (finance system, etc).
- Initial pricing to Defoe is ~$2000/mo, and with SaaS services prices are subject to annual increases (that can be difficult to predict). Home-grown solution cost is more stable, showing initial capital expense and minor subsequent operational expense to maintain function.

Preparation for next step

When considering the next steps for integrating we need to address 4 key steps. First we need to determine the scope of users and how much support will be needed to grant users access to the data. We also need to consider how much historical data we want to include at launch. The second step would be to build a team to handle the full integration which will consist of a variety of IT support staff and key users for early testing. We also need users who can understand the data and that all stakeholder requirements are satisfied. The third step would be to ensure the fully integrated system is accurate and that the existing web pages are working from a latency standpoint over several weeks. We will want to test and verify the data flow to ensure the data is consistent and accurate. Lastly we want to ensure we have a go live date and back up plan in case of issues.

Closing

While the construction industry is built on manual labor the improvements in technology cannot be ignored. We feel from an offering standpoint we have adequately provided Defoe with two viable options that can support all the major pain points in their day to day. We feel we can adequately support the integration of either the in house solution or third party service for the client and ensure that that management can focus more on running production and project expectations while smoothing out the costly delays associated with budget management and approving budget requests.