

SPRING 2024

Montgomery County Department of Environmental Protection **Customer Journey Mapping & Information Workflow Improvement**

STUDENTS

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UNDER THE SUPERVISION OF

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COURSE

INST 776: HCIM Capstone Project

PALS

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Table of Contents

[Project Introduction](#)

[Tasks & Methodology: Design Sprints](#)

[Sprint #1: Understanding the Problem](#)

[Sprint #2: Researching Potential Solutions](#)

[Sprint #3: Deciding on a Design Solution](#)

[Sprint #4: Wireframing & User Testing](#)

[Sprint #5: Final Designs & User Testing Round #2](#)

[Project Conclusion](#)

Project Introduction

CLIENT OVERVIEW

The Montgomery County, Maryland Department of Environmental Protection (DEP) is responsible for trash and recycling services across the county including the management and distribution of trash and recycling bins and carts. Requests for new or replacement bins and carts are first processed through the county's service desk operations (MC311) and then provided to the team responsible for product delivery. This information must then be manually manipulated and outputted to staff members and contractors to organize, schedule, and process deliveries and pickups. The manual workflow processes and limited technology integration create process inefficiencies leading to suboptimal customer satisfaction.

PROJECT GOAL

The DEP sought to improve service delivery and customer satisfaction by mapping the customer journey and associated information workflow. Based on these workflows, DEP requested improvements to its information workflow and technology use.

PROJECT SCOPE

During the Fall 2023 semester, our team conducted background, content, and user research to understand the motivations, needs, constraints, and expected outcomes of this analysis. We also conducted research into similar solutions on the open market for insight and ideas on how to address the county's needs. We used the findings to ideate and generate product concepts and recommend potential solutions to DEP.

During the Spring 2024 semester, the team generated detailed designs and mockups and validated them through additional user research and testing, producing a clickable demonstration prototype. The team then implemented user feedback resulting in high-fidelity prototypes for a second round of user testing. The final step was creating business case documentation, developer documentation, and other deliverables to complete the client hand-off.

The specific client requests were:

1. Map the customer journey and internal processes from the initiation of a customer bin request through request fulfillment, paying particular attention to the existing organizational and technical limitations and challenges.
2. Conduct user experience research with DEP staff to understand the current information flow and the challenges staff face working within technical and organizational limitations.
3. Perform additional research and develop user-centered solutions to coordinate the management and flow of information with DEP operations to improve service delivery and the exchange of information with external stakeholders to improve customer satisfaction.

Tasks & Methodology: Design Sprints

Our team completed its tasks iteratively, in 4-5 weeks "sprints," where each sprint involved research and analysis, ideation, design, evaluation, and refinement. This approach is based on the Google Ventures Design Sprint process (see <https://www.gv.com/sprint/>), adapted to an educational context.

RESEARCH AND ANALYSIS

- Attended an initial project briefing where the client presented an overview of relevant business aspects and their end-users and demonstrated existing systems. The project team and client reviewed the project goals, objectives, and schedule.
- Conducted in-depth interviews with client staff to understand the current service delivery model and the information flow that supports it.
- Mapped the current information flow, including the performed manual processes.
- Conducted background research on technology solutions that can improve information workflow within the existing organizational and technical limitations identified in the interview process.
- Identified solutions for improving information workflow within DEP to address information processing bottlenecks and improve internal and external communications.
- Consolidated interview data into summary and detailed findings, used to construct visual models.

IDEATION

- The team iteratively generated design concepts for improving information flow and service delivery. This included identifying additional tools to support DEP operational staff.

- The team presented its high-level product concepts. Together, the client and the team prioritized which concepts to pursue.

DESIGN, EVALUATE, AND REFINE

- Designed initial mock-up: Using the design concepts, the team identified proposed features and interface changes into a low-fidelity mock-up to be tested with users.
- Iterative design: Over a series of user tests with DEP staff, the team evaluated and refined the product design. This included designing the interactive and visual appearance, ensuring usability and accessibility while addressing the business goal.
- Design review meetings: The team conducted reviews with the client as per the schedule to share findings and directions.
- Final deliverable meeting: The team gave an overview of the project and the user data, and presented the final design prototype with clear documentation for ongoing implementation.

Sprint #1:

Understanding the Problem

SPRINT #1 GOALS

- Map and understand the current process and areas of friction
- Identify and prioritize pain points in the process

CLIENT KICKOFF MEETING

The project began with a client kickoff meeting to make introductions and to understand the DEP team's goals for the project. The DEP team included three main contacts:

- John Nenghabi (supervisor)
- Lina Paz (office manager)
- James Buhl (lead driver)

UNDERSTANDING THE EXISTING PROCESS

To gain a thorough understanding of DEP's existing process, Lina Paz gave a detailed walkthrough of the office side of the process, which included data cleaning, scheduling, and managing request status updates.

An on-site visit with James Buhl at the DEP facility illustrated the process from the drivers' side. This included a demonstration of the data cleaning and route planning that each of the drivers do before heading out on the road. The team followed James for the first several stops on his route to see how he navigates between stops and keeps track of his progress.

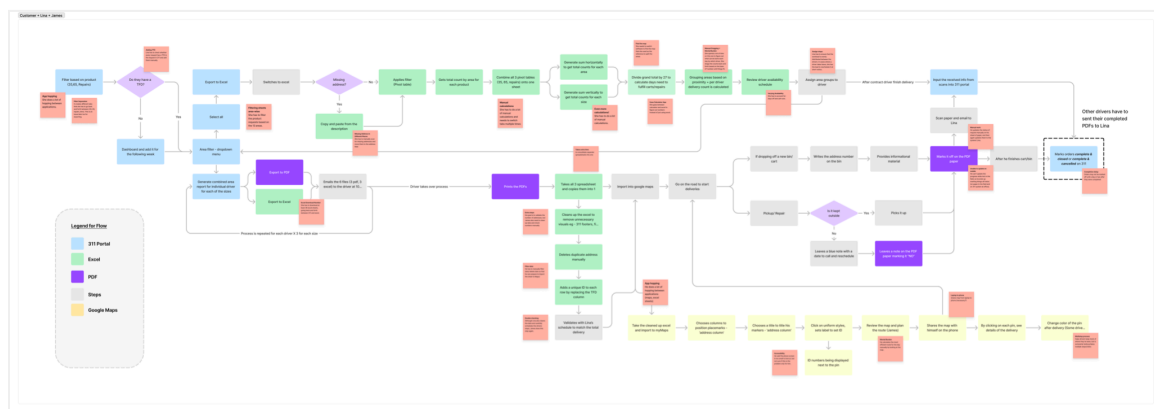
MAPPING THE WORKFLOW

Using information from these meetings, the team created a detailed workflow diagram of the step-by-step process from beginning to end (see Figure 1.1). Steps were color-coded according to the software used. Mapping the entire process allowed us to identify pain points and areas of friction where improvements could be made.

Key takeaways from the workflow diagram are:

- users are frequently required to switch back and forth between multiple applications (311, Excel, Outlook, Google Maps, etc.)
- there are several loops where sequences of steps must be repeated multiple times
- users find it challenging to calculate efficient schedules and driving routes.

Figure 1.1 Workflow Diagram



DISTILLING THINGS DOWN

To facilitate discussions and make things easier to digest, we created a simplified “Day in the Life” workflow (see Figure 1.2). This graphic representation of the process and pain points allowed us to confirmed our understanding with the client and target discussions about priorities and goals for moving forward.

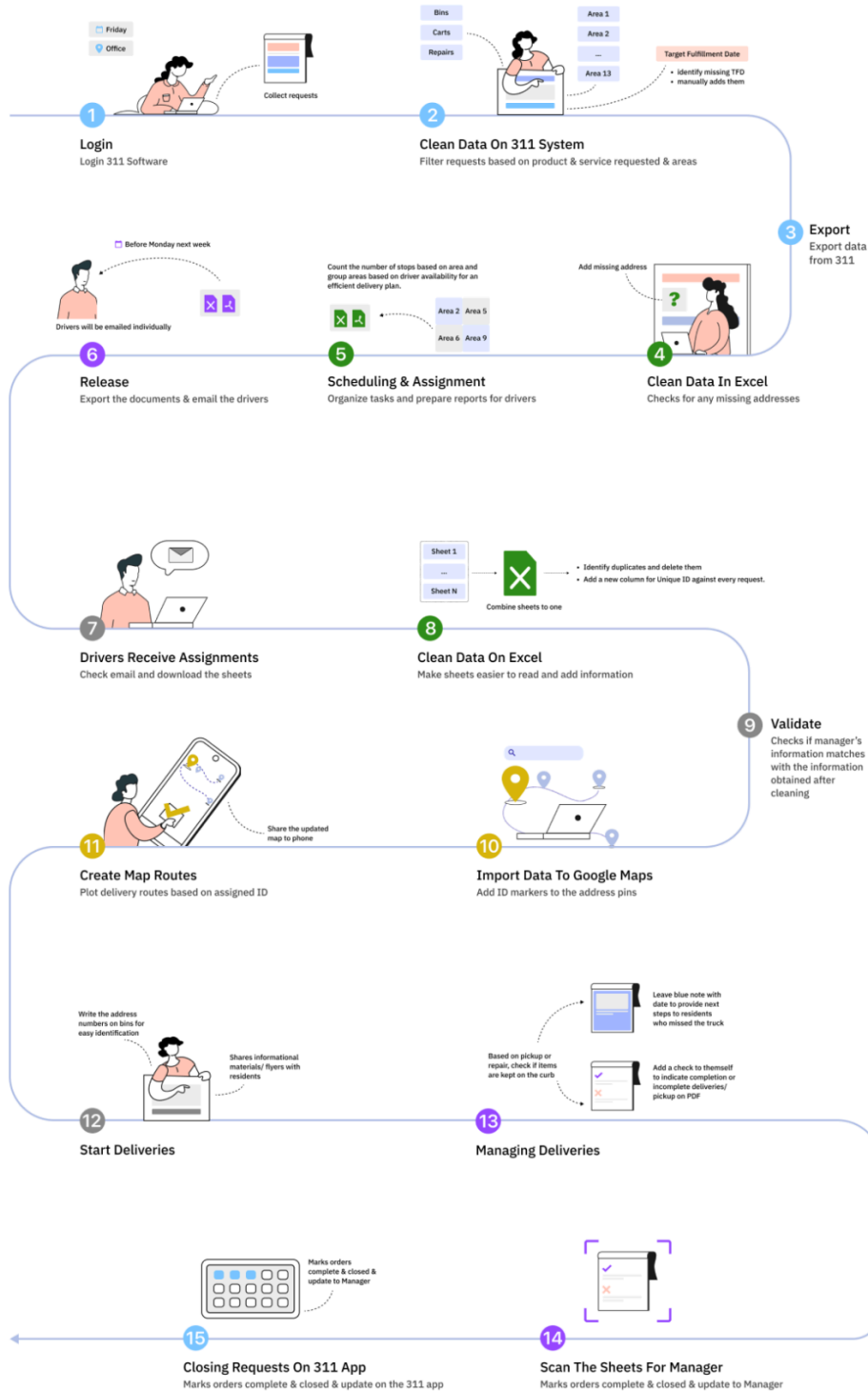
Figure 1.2 Day in the Life

Day In The Life

Department Of Environmental Protection

Application Used

- 311 Portal
- Excel
- PDFs
- External steps
- Maps



PRIORITIZING GOALS

Based on discussions with the client and the identified pain points the team listed high-level project goals. In the final Sprint #1 meeting, the client gave feedback on which goals were most important, resulting in a prioritized list to address in Sprint #2.

1. Streamline data processing and scheduling
2. Simple tracking of completed and pending tasks
3. Reduce manual and repetitive work in task closure
4. Streamline route planning
5. Narrow drop-off window
6. Provide recommendations to improve 311 in the future

Sprint #2:

Researching Potential Solutions

SPRINT #2 GOALS

- Conduct a competitive analysis of software tools that handle data processing, automation, and route planning.
- Discuss the technical feasibility of designing interfaces from scratch and understand dependency with backend teams.
- Propose a design solution that improves the system within time and budget considerations.

COMPETITIVE ANALYSIS

Based on the process understanding from Sprint #1, we started this sprint by analyzing various data processing and routing tools to understand their features and workflows in relation to DEP's needs.

The research began with identifying the most important features required to achieve a robust solution. These features ranged from the different functionalities and pain points identified during the kickoff sprint.

Following the feature analysis, the team conducted a competitive analysis of more than 30 data processing and routing software options. This comparison narrowed down the software list and categorized potential software based on their role in the DEP's existing workflow.

Figure 2.1 Software Comparison Based on Features

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	Figma Link - screenshot analysis of the below research															
2	Data Processing	Knack	Tadabase	RouteWare	AMCS	Rubicon	Airtable	Jira	Asana	Connecteam	Shiftboard	Paycor	SAP	Retool	Caspio	Basecamp
3	Allow multiple formats for downloading/ exporting	Yes	Yes	Unsure	Yes	Yes	Yes	No	No	No	Unsure	Unsure	Unsure	Yes	Yes	Yes
4	Have extensive data table functionalities	Yes	Yes	Unsure	Yes	Yes	Yes	No	No	Unsure	Unsure	Unsure	Unsure	Yes	Yes	No
5	Good to have - allow note taking capabilities to a specific row/ order	Yes	Yes	Unsure	Unsure	Unsure	Yes	Yes	Yes	Unsure	Unsure	Unsure	Unsure	Yes	Yes	Unsure
6	Create folders/ categories to assign the data in - Having an archive section	Yes	Yes	Unsure	Yes	Unsure	No	No	Yes	Unsure	Unsure	Unsure	Unsure	Yes	Yes	Yes
7	Good to have - Mobile responsiveness	No	Unsure	Yes	Yes	Yes	Unsure	Yes	Yes	Yes	Unsure	Yes	Unsure	Yes	Yes	Yes
8	Notifications - Does it provide real time updates of changes made by other users?	Unsure	Unsure	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unsure	Unsure	Unsure	Unsure	No
9	Must be able to have multiple users - invite them	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unsure	Yes	Yes	Yes
10	Sync weekly schedule to calendar with employees directly. - visually	Unsure	Yes	Yes	Yes	Yes	Unsure	No	Yes	Yes	Yes	Unsure	Unsure	No	Unsure	Yes
11	Be able to communicate with multiple softwares using APIs	Yes	Yes	Unsure	Yes	Yes	Yes	No	Yes	Unsure	Unsure	Unsure	Unsure	Yes	Yes	Yes
12	Assign Roles and permissions within the software. - per page capabilities (Edit/ View)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unsure	Partial	Partial	Yes
13	Be compliant with the government tools? - need to confirm if this is even needed?	Unsure	Unsure	Unsure	Unsure	Yes	Unsure	Unsure	Yes	Unsure	Unsure	Unsure	Unsure	Unsure	Unsure	Unsure
14	Assign tasks or information to specific users with the software	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unsure	Unsure	Partial	Yes	Yes
15	Customizable interfaces? To what extent can changes be made?	Yes	Yes	Unsure	Yes	Yes	Yes	No	No	Unsure	Unsure	Unsure	Unsure	Yes	Yes	Yes
16	Customizable filters to manipulate the table	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Unsure	Unsure	Unsure	Yes	No	Yes
17	Good to have - Create a saved search - create pre-saved filters	Yes	Yes	Unsure	Yes	Yes	Yes	No	No	Unsure	Unsure	Unsure	Unsure	No	No	No
18	Table calculations?	Yes	Yes	Unsure	Yes	Yes	Yes	No	No	Unsure	Unsure	Unsure	Unsure	No	No	No
19	Easy to troubleshoot - customer support	Yes	Yes	Yes	Yes	Yes	Yes	Unsure	Yes	Yes	Unsure	Yes	Unsure	Yes	Yes	Yes
20	Easy to migrate to the software - upload docs from the system	Unsure	Unsure	Unsure	Unsure	Yes	Yes	No	No	Unsure	Unsure	Unsure	Unsure	Yes	Yes	Yes

TECHNICAL FEASIBILITY

For any of the proposed solutions to work, integration with the 311 portal was crucial. As a government project, there was heavy emphasis on security, data accessibility, and team support. To get an understanding of IT capabilities within 311, the team met with the DEP IT staff and 311 IT staff. The capabilities and limitations discussed helped narrow down the possible solutions.

PROPOSED SOLUTIONS

With insights from the deep-dive research into the current software and an understanding of DEP's technical capabilities, the team refined its objectives. We realigned the goals based on these insights, settling on three potential solutions. The goal was to present these solutions to the county with a cost-benefit analysis to make the most impactful decision based on budget, time, and resources.

At the end of the sprint, we proposed the following solutions:

1. Integrating External Software

This would involve procuring external software that increases DEP's capability to efficiently conduct data processing, scheduling, and route planning. The goal was to find an all-in-one solution that could integrate with the existing 311 system (and any 311 updates). Though this solution seemed the most viable, it also came with trade-offs like a monthly/annually paid subscription, security clearances, and county approvals.

2. Update Existing Case Management System

During the technical calls, the team learned that DEP IT POC had created a case management system using Oracle's Scooby database to manage requests. The abilities of this system could potentially be furthered adding in functionalities to assist the drivers and office team. This option involves the DEP IT and 311 IT departments changing the existing case management system.

While this option uses existing resources, it relies heavily on the DEP and 311 IT teams to pursue resource approvals, training, and solution development.

3. Leverage Current DEP Software Licenses

Leveraging DEP's current software licenses would eliminate the need for security approval. Tools such as Excel and Microsoft Teams are already used in some form by the back-office team and could be optimized to address DEP's workflow pain points. This could include integrating previously under-used tools such as Microsoft Power Automate, Microsoft Power Apps, and ArcGIS.

Sprint #3:

Deciding on a Design Solution

SPRINT #3 GOALS

- Decide on design solutions from the proposed three solutions.
- Deliver information architecture and user flow for the design solution that becomes a framework for the application that improves the DEP team workflow.
- Project planning for Sprints #4 and #5.

CLIENT CHANGE & DECISION-MAKING

At the end of sprint #2, the original DEP supervisor departed, leaving the project in need of a new final decision-maker. The position was not filled until the second week of this sprint. Nevertheless, the process moved forward with:

- continued communication efforts with stakeholders
- multiple meetings with clients and new point of contact
- presentation of the option's benefits and tradeoffs
- an informed recommendation to the client (Option #2), which they ultimately chose.

The consulting team relies on clients' input and ideas to advance the project. The client was presented with three analyzed options and received a definitive response on the project direction in the fourth week of this sprint> Accordingly, we focused efforts on prepping for a heavy workload in the next two sprints.

IDEAL FLOW

Based on the information from previous sprints, an ideal flow was developed for a new bin delivery system based on existing workflow stages (see Figures 3.1 – 3.3).

Figure 3.1 Ideal Flow - Getting Data Ready

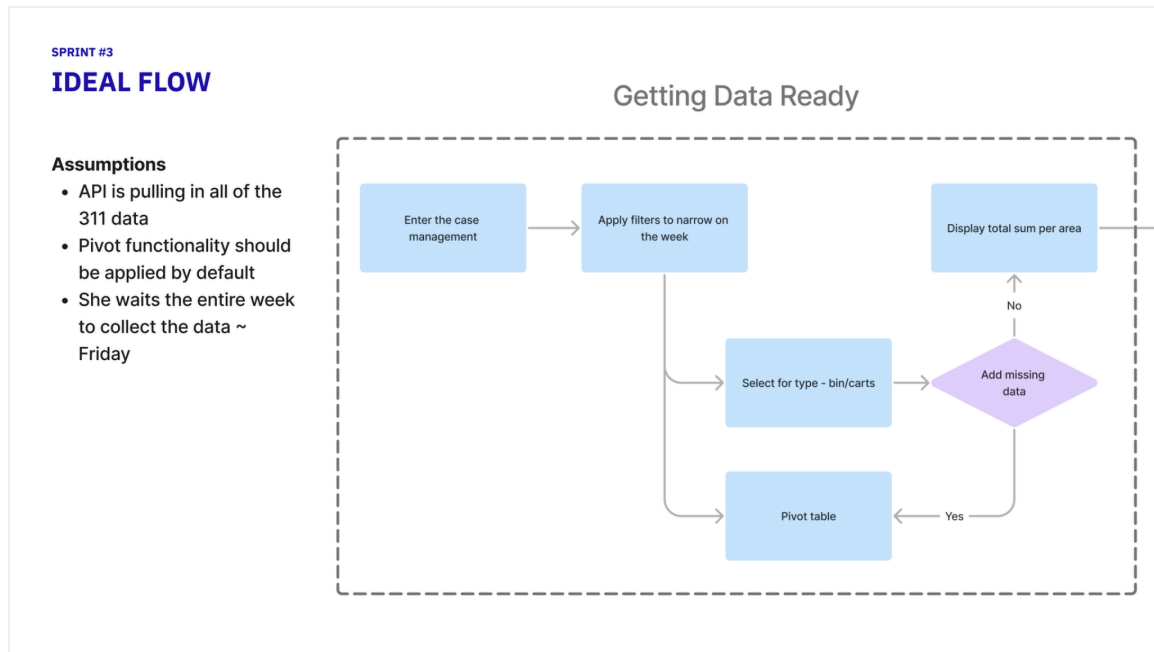


Figure 3.2 Ideal Flow - Scheduling

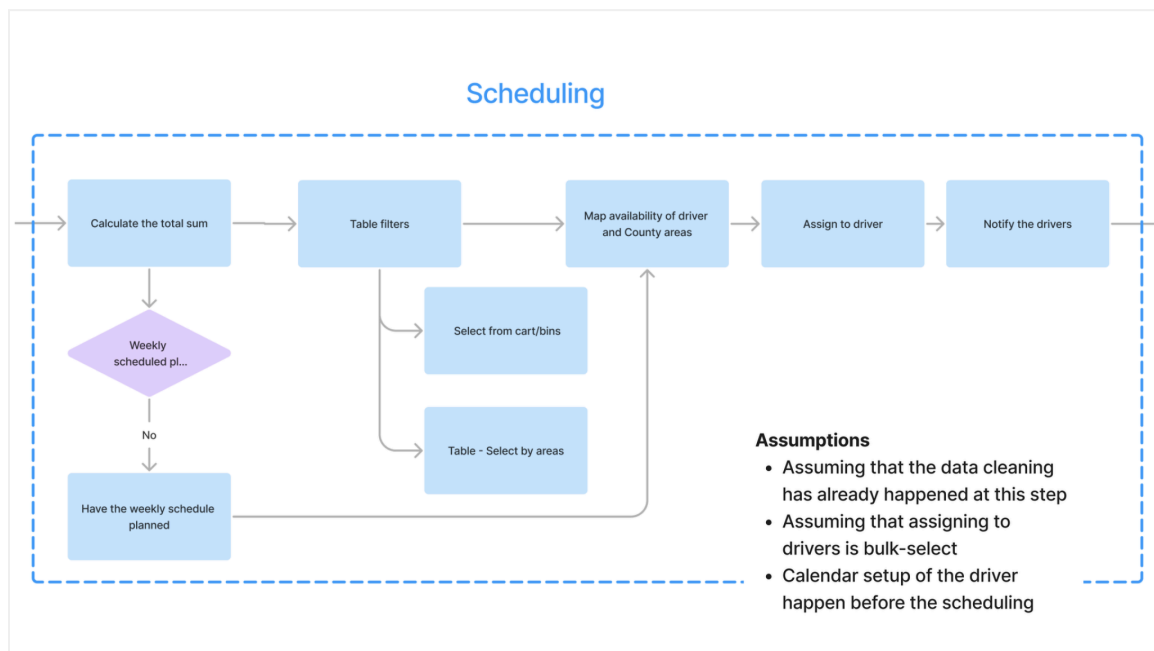
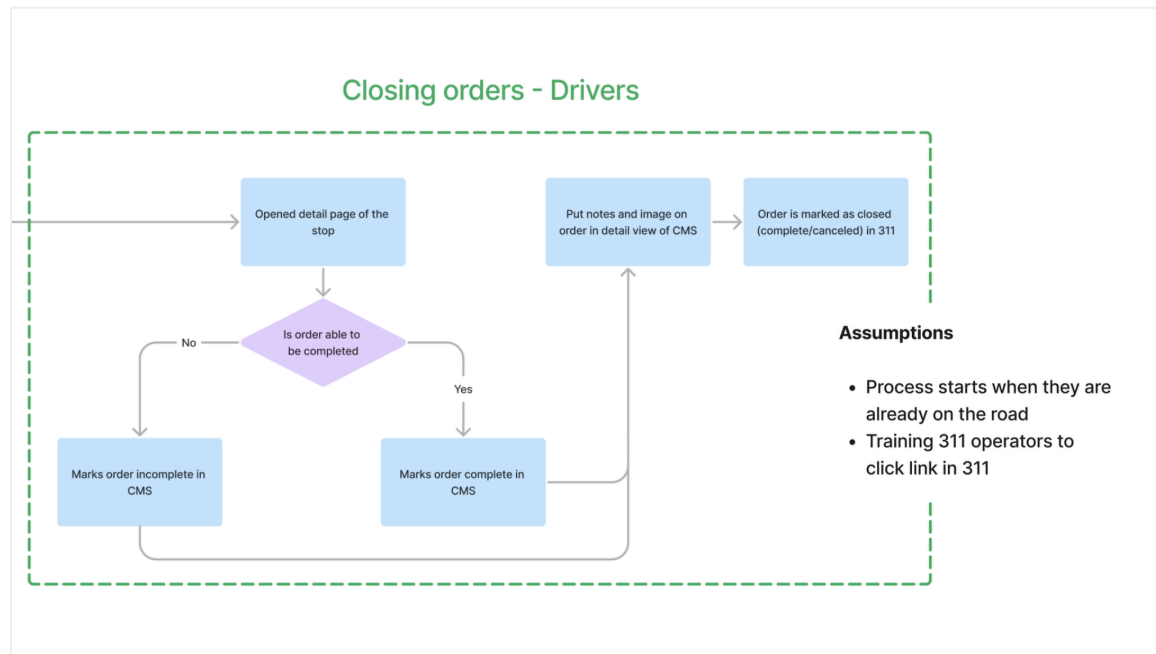


Image 3.3 Ideal Flow - Closing Orders - Drivers

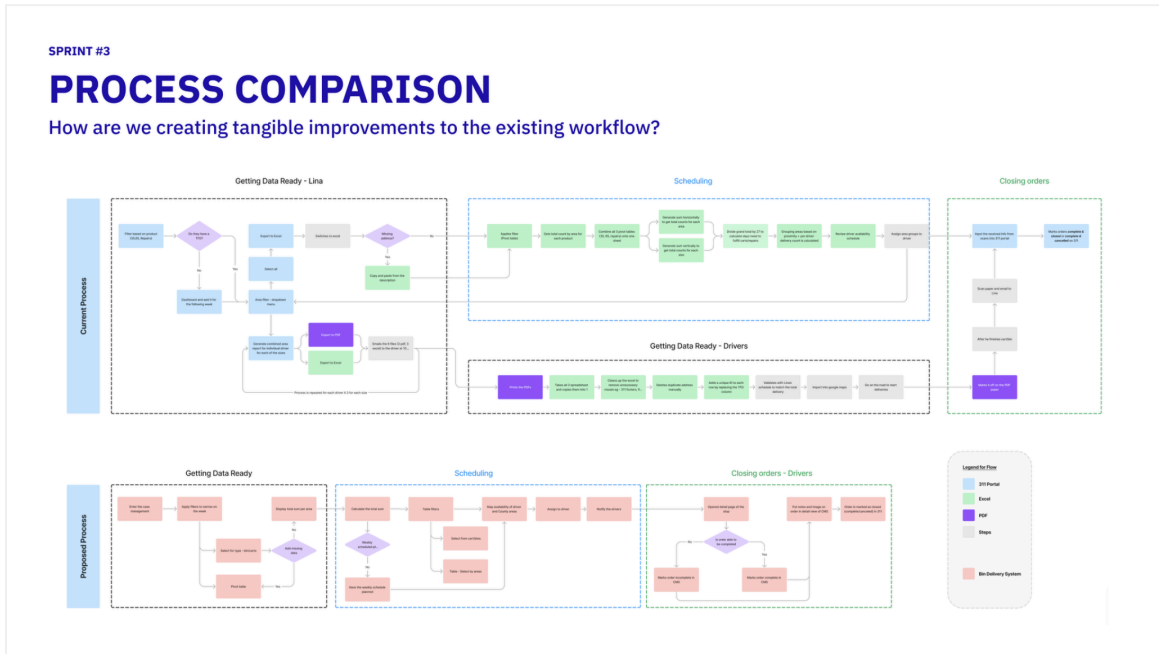


PROCESS BENEFITS

As displayed in the process comparison (Figure 3.4), the team created tangible improvements to the existing workflow, including:

- **Improved Software Integration:** Three systems sync with each other and reduce external software use (Google Maps, Excel, etc).
- **Reduced Steps Required:** A 40% decrease in the number of steps.
- **Eliminated Process Overlap:** Drivers are not required to clean data for route planning.
- **Real-Time Updates in CMS:** Drivers can close requests in the field.
- **Improved Customer Communication:** Residents are automatically notified when their request is complete.
- **New Features:** New features improve communication, efficiency, and usability.

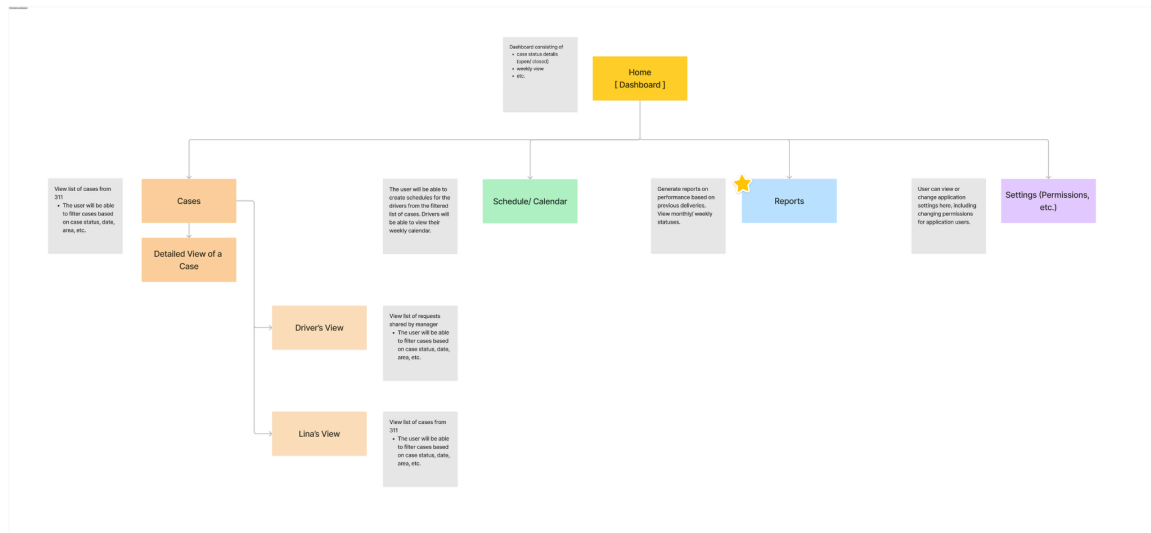
Figure 3.4 Process Comparison



INFORMATION ARCHITECTURE

Based on the gathered information and the existing bin delivery system, the team created an information architecture for the site (see Figure 3.5). Information architecture (IA) is a visual representation of the application's infrastructure, features, and hierarchy. An IA may also include navigation, application functions and behaviors, content, and flows.

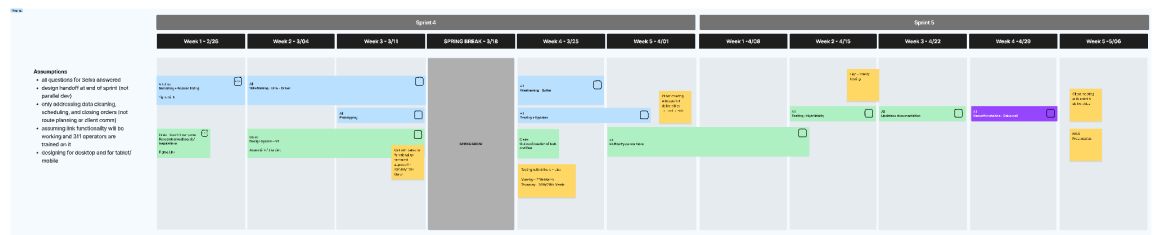
Image 3.5 Information Architecture



PROJECT TIMELINE

To ensure a successful project and a smooth transition, the tentative timeline suggests dates for usability testing and meetings (see Figure 3.6). The timeline depends on the availability for user testing. It also accounts for development; because development will be done after handoff, the timeline includes time for developer documentation and a meeting with the IT team.

Image 3.6 Project Timeline



Sprint #4:

Wireframing & User Testing

SPRINT #4 GOALS

- Design prototypes that align with the research and improve workflow efficiency.
- Conduct user testing for both the office and drivers' team to refine the initial design.

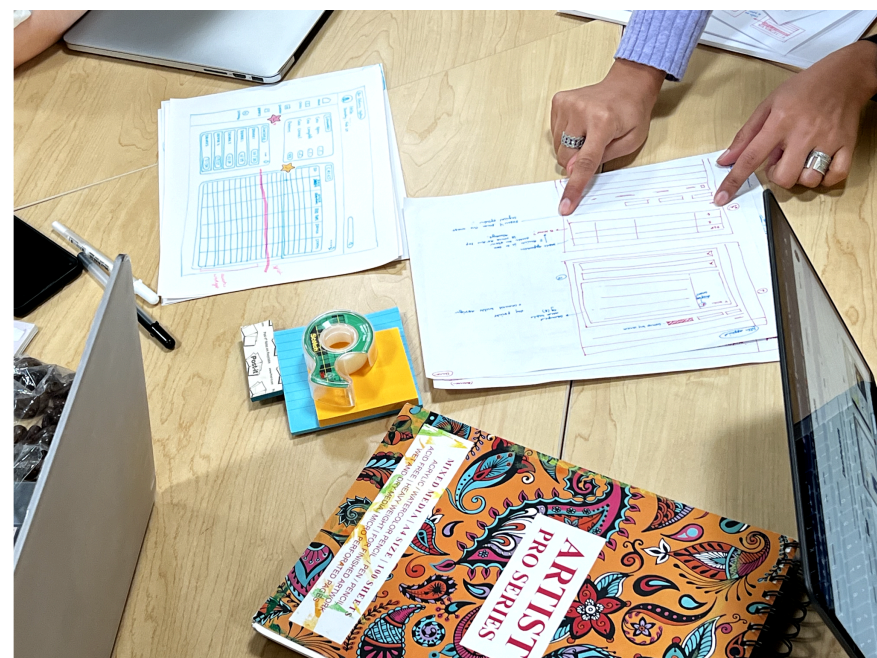
On a tight schedule, the final two sprints were reserved to develop the design and test it to accommodate the user needs as well as ensure technical feasibility.

SKETCHES FOR THE BIN DELIVERY SYSTEM

Analyzing the information architecture from the previous sprint allowed the team to fully understand the project requirements and identify gaps in the existing design. We considered feedback from the previous sprint and used it as a starting point to create a more refined version of the system.

Based on analysis, the team sketched ideas and features that would effectively support the system's goals (see Figures 4.1). The goal was to develop an intuitive, user-friendly design that meets the needs of all stakeholders. We also ensured that the design was scalable and could accommodate future growth and changes.

Figure 4.1: Sketch Process for the Bin Delivery System Application



DESIGNING A LOW-FIDELITY PROTOTYPE

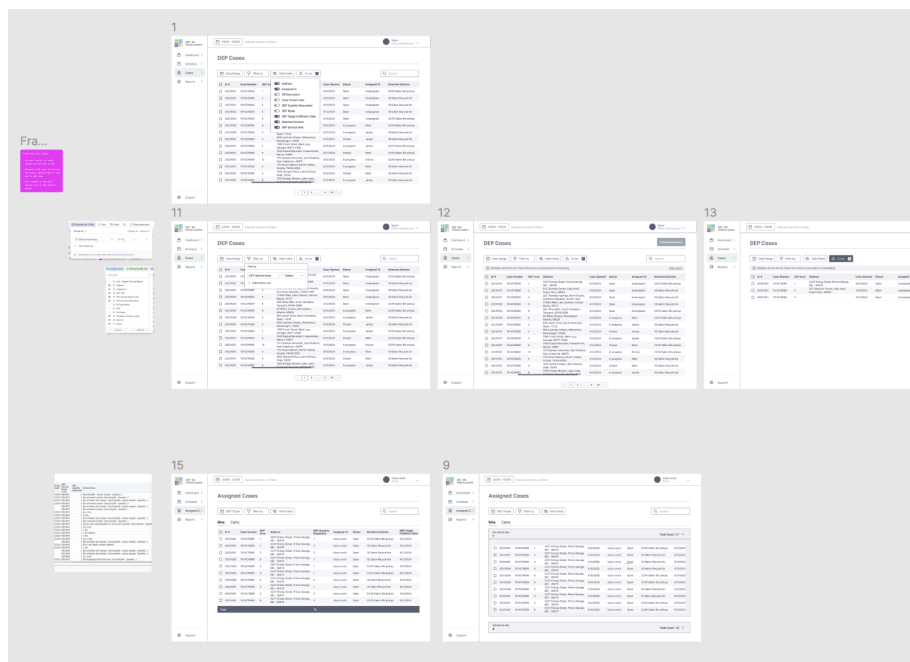
After finalizing initial sketches, the team created mid-fidelity prototypes in Figma to provide a more detailed representation of the design (see Figure 4.2). These prototypes focused on the design's functionality and workflow, for testing and refining the user experience. The team considered every aspect of the design, including button placement, information flow, and the user interface.

Once the system's initial screens were complete, the team turned to DEP's IT developer to refine and develop a shared understanding of how the system would work. DEP's insights into the system's functionality were:

- the availability of tablets for drivers, making the screens responsive (designing both desktop and tablet versions)
- integration with ArcGIS for route mapping
- integration with PowerBI to generate reports.

This feedback was incorporated into the design and tested through clickable prototypes. The prototypes were interactive and allowed the team to test the new design elements before implementing them.

Figure 4.2: Mid-fidelity Screens on Figma



CONDUCTING USER TESTING FOR THE PROTOTYPE

The design process had to ensure that the system was user-friendly and easy to use for those using it every day. User testing with five drivers and two office managers gave a comprehensive understanding of their needs and requirements.

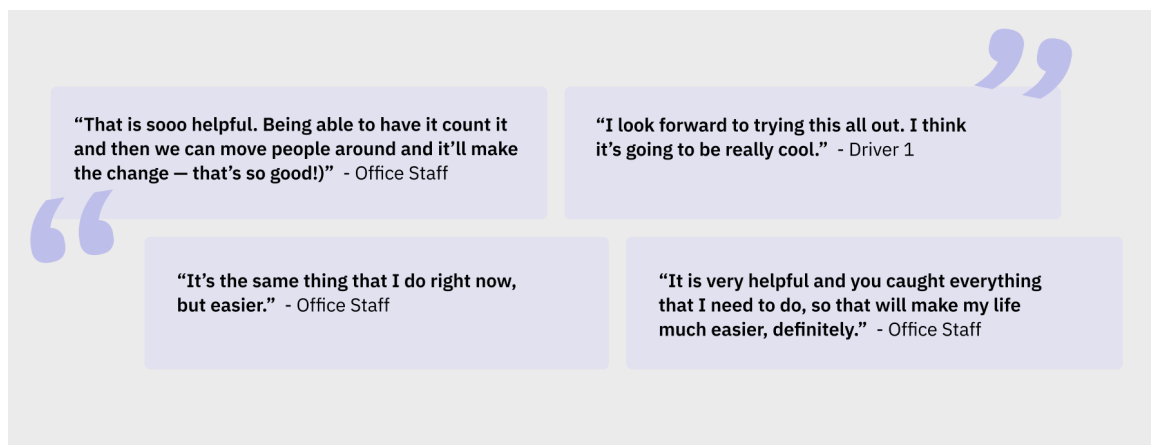
The testing process included task-based scenarios designed to reflect real-world situations and workflows that users would encounter while using the system. This approach allowed the team to evaluate the designs in a practical context, identifying areas where users encountered difficulties and where improvements could be made.

INSIGHTS FROM USER TESTING #1

The team conducted an interpretation session after the drivers' and office managers' user testing and identified specific pain points for users, such as difficulty completing a task or navigating the system. This information supported design improvements to better meet users' needs, ultimately resulting in a more intuitive and user-friendly experience.

The excellent feedback on the mid-fidelity prototypes from the user testing, gave the team insights that helped further improve the application (see Figure 4.3).

Image 4.3 Participant feedback during User Testing



Insights from the Office-side of the Application:

- When scheduling, having the ability to look at past weeks and start planning for next week based on driver availability.
- Managing edge cases by giving a clearer indication of duplicates, potentially by grouping, which helps identify and clear errors from the schedule.
- The need for a “review” status allowing drivers to get help from the office team when they have questions or need more information.
- Clearer segregation of workflows with indications in the system of what needs to be completed in 311 vs the system.

Insights from the Driver-side of the Application:

- Prioritization of information in the cases table and detail view, showing only the most important data visible during deliveries, along with the option to group orders.
- Ability to optimize planning within the system to efficiently map areas of overlapping deliveries, eventually assisting them in removing this manual step.
- Rethinking how the system manages edge scenarios like “needing review” and the ability to reopen cases once an order has been closed.

Sprint #5: Final Designs & User Testing Round #2

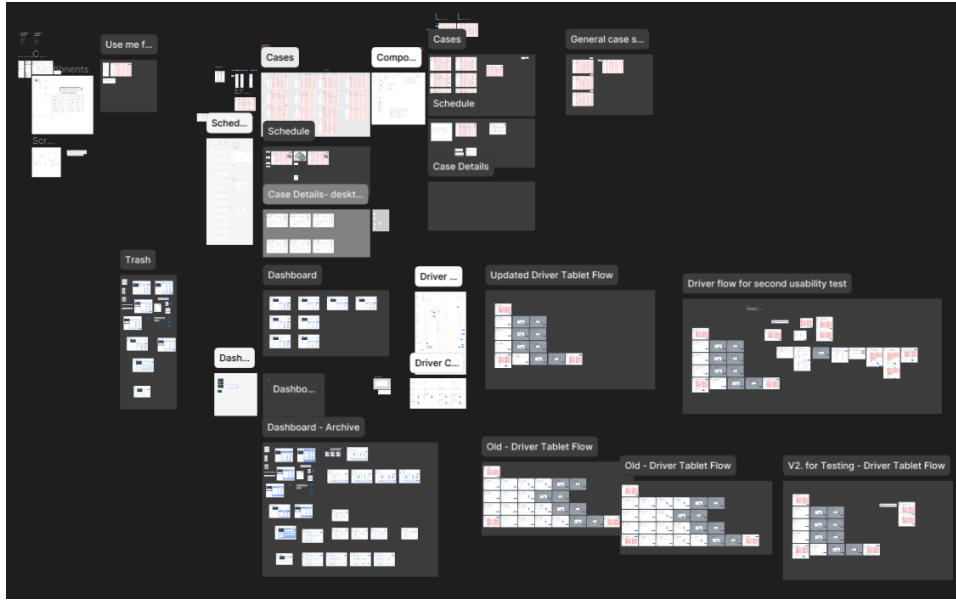
SPRINT #5 GOALS

- Design high-fidelity prototypes and establish a design system with detailed components and visual design.
- Final user testing to confirm design refinements.
- Develop and present the project report with developer documentation and training documentation for the proposed Bin Delivery System.

DESIGNING HIGH-FIDELITY PROTOTYPES

This final sprint began by incorporating the feedback from the first round of user testing into the designs. The main features of the Bin Delivery System application were refined in a high-fidelity version of the application (see Figure 5.1).

Image 5.1: High-fidelity Screens on Figma



CONDUCT USER TESTING WITH FINAL SCREENS

Pilot testing and user testing on the high-fidelity screens was conducted for the office and driver sides of the application. The testing focused on visual elements and overall usability, unlike the first user testing, which focused on functionality.

Two office staff and three drivers were asked to perform tasks from their daily routines and were then asked for their thoughts about certain features in the application (see Figures 5.2 and 5.3). The testing results provided crucial feedback for finalizing the application's design.

Figure 5.2 Drivers' Task Analysis

Task Analysis - Drivers

- ▶ Goals
- ▶ Starting the Test

▼ Scenario 1: In Office

Imagine it's Monday morning, and you've already received an email from Lina about your assigned cases. You're in the office and getting started for the day, and you're looking at the desktop view of the bin delivery system. For these tasks, you will be Driver #2.

- Start at schedule page
 - Please take a look at the schedule page and let us know your thoughts
 - How many bins and carts will you need for the week?
 - My Cases
 - Can you please show me how you would group the table info by route codes?
 - How many route codes have both assigned bins and carts?
 - If you're covering the first two route codes in the table, how many bins and carts would you load your truck with for today based on the info here?
 - Follow Up: Thoughts on this?
- ▶ Scenario 2: On the Road (case details, complete, incomplete, and needs review)
 - ▶ Scenario 3: Changing Case Status
 - ▶ Scenario 4: Alternates & Final Thoughts

Figure 5.3 Office Staff Task Analysis

Task Analysis - Office

Screen sharing/control note - instruct them to look for "my name"

- ▶ Goals
- ▶ Timing
- ▶ Instructions

- ▶ Scenario 1: It is Friday - Data cleaning process
- ▶ Scenario 2: It is mid-week - Handling different cases and viewing status
- ▶ Scenario 3: Editing schedule when a driver calls in sick
- ▼ Scenario 4: Overall look and feel of the application

Now coming to the final scenario - this is a random day during the week. You have opened the Bin Delivery System application on your desktop.

Task 1: Looks and feels

What do you think of the application? Navigate to the different pages on the application. Can you share your thoughts on how easy or difficult it is to understand how the application works? Do you find it easy or difficult to get adjusted to this application?

Questions:

- Is there any task that you think this application should do but it is not currently added?
- What do you think about the visual design? Colors, font, font sizes, etc.?
- Is the content easy to grasp? Does you understand the different between the terminologies used on the application?

INSIGHTS FROM USER TESTING #2

Both user testing sessions provided valuable insights that led to tailored user experiences for drivers and office staff.

- Consider Edge Cases: Beyond the standard complete/ incomplete flow, are scenarios that would have been missed, such as flagging cases and changing documentation.

- **Reduce Mental Math for Loading the Trucks:** The current process requires drivers to figure out how many bins or carts they need to load each day. The new system automatically calculates for them.
- **Handling Multiple v. Single SRs:** The designs incorporate multiple SRs into one screen, while still maintaining the ability to document them separately. This is based on the drivers' need to both pick-up and deliver at the same address.

FINALIZE THE DESIGN SYSTEM

The team made changes to the screens and finalized the design system for the Bin Delivery System (see Figures 5.4 - 5.6). At this point, the color, typography, and other visual design elements were chosen.

Figure 5.4 Design Library for the Bin Delivery System Application

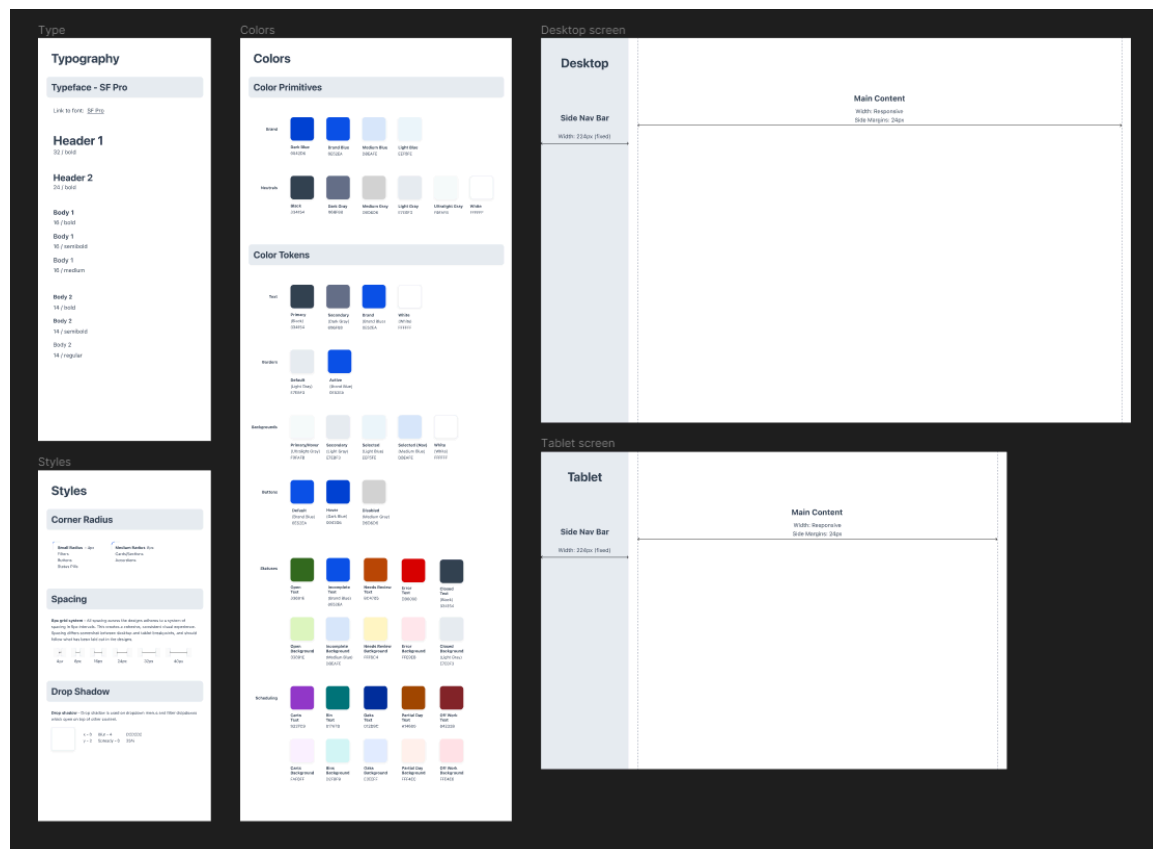


Figure 5.5 Component Library for the Bin Delivery System Application

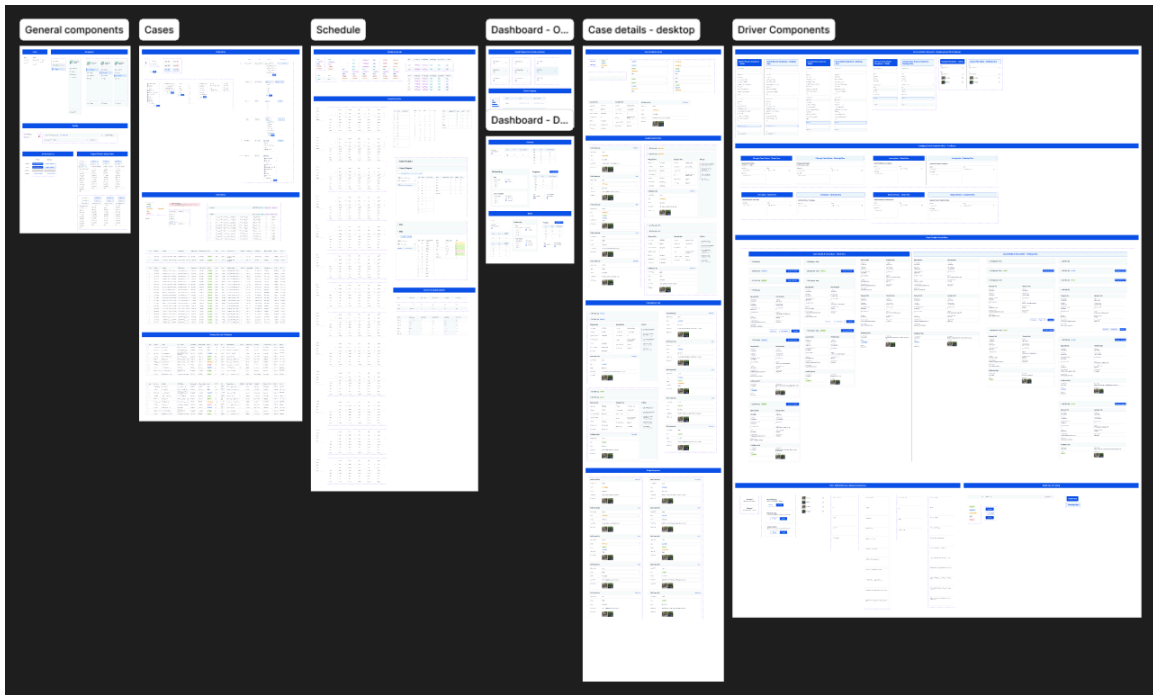
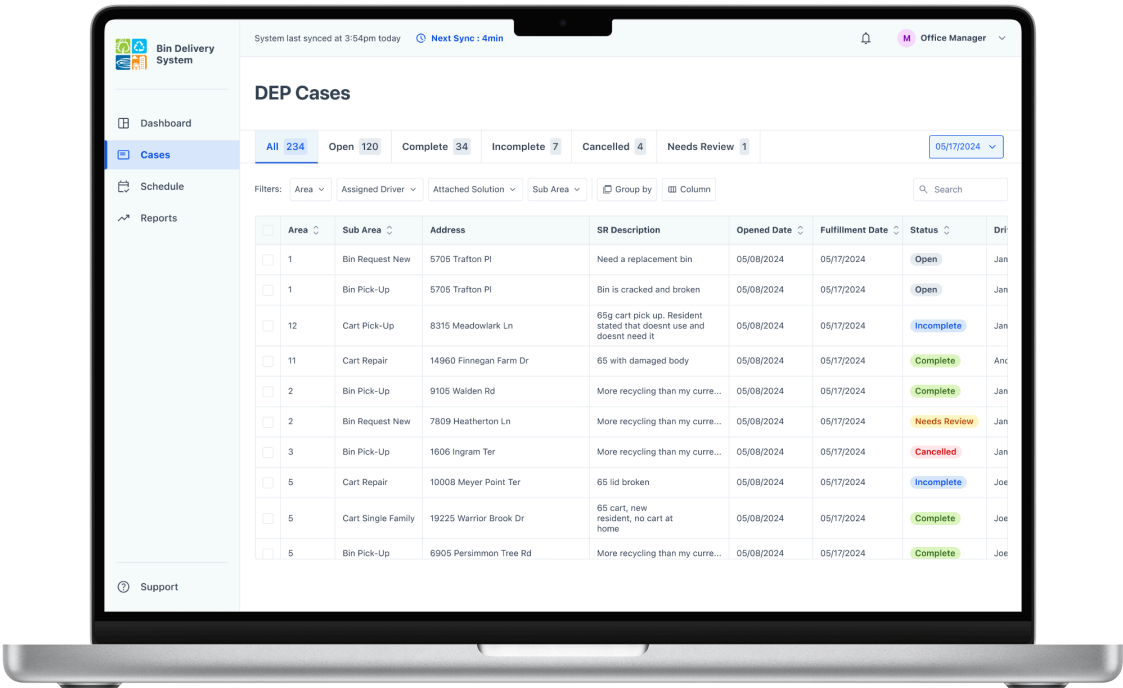


Figure 5.6 Final Appearance of the Bin Delivery System Application



DEVELOPER DOCUMENTATION FOR THE BIN DELIVERY SYSTEM

Once the Bin Delivery System's final screen was ready, the team wrote the developer document to be used as a reference by the IT team when they start work on developing the Bin Delivery System. The document illustrates key screens and functionalities of the system with specific call-outs and notes, allowing the IT team to create the system on their own. The document also includes a training section that outlines how to use the application's features and its limitations.

Project Conclusion

SUMMARY OF OUTCOMES

- 1. Bin Delivery System:** The Bin Delivery System is designed to enhance workflows for the DEP team. It offers streamlined scheduling, real-time data, and on-road case tracking for drivers and office managers.
- 2. Workflow for Managers:** The new system allows managers to efficiently handle requests from the 311 system, calculating workload and scheduling deliveries for drivers. This reduces manual tasks, streamlining operations and boosting productivity.
- 3. Workflow for Drivers:** The new system integrates with the ArcGIS system, enabling drivers to use tablets to efficiently track cases and address any potential issues in the field.
- 4. Documentation for the IT Team:** To ensure successful implementation and use, the team developed several essential documents, including developer documentation, business documentation, and training documentation.

IMPLEMENTATION

Since we are a research and design team, the development and implementation will rely on the DEP IT team. Aspects of implementation, such as procuring tablets for drivers will happen on a longer timeline, dependent on factors such as budgetary constraints and approvals.

CONCLUSION

This project successfully streamlined workflows for the DEP team by developing a comprehensive data management system and documentation, significantly improving operational efficiencies and supporting the DEP's mission to better serve the community.

ACKNOWLEDGEMENTS

We extend our thanks to the DEP team, Dr. Lutters, and PALS for their support and assistance throughout this project.