

**Company ABC Consolidation**

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## **Abstract**

This project aims to solve Company ABC's issues in order to keep the company afloat and to keep the company profitable. This was done by reducing Company ABC's organizational and inventory build-up issues. The project aims to reduce the company's dependence on outside storage, with plans of consistent inventory reduction over the next year. An implementation plan was created to ensure the company keeps on track to increase profits and prevent against increasing inventory costs.

## Table of Contents

Abstract .....	1
List of Equations .....	3
List of Figures .....	3
List of Tables .....	3
Introduction .....	4
Background .....	7
Literature Review .....	9
Organization and Waste Reduction of Current Facility and Storage Units.....	9
Facility Redesign Upstairs .....	10
Facility Redesign for the Downstairs Office Space.....	13
Vendor Database .....	15
Design.....	17
Vendor Database .....	17
Standard Operating Procedures .....	19
Upstairs Layout .....	20
Downstairs Office Layout.....	23
Methods.....	25
Vendor Database and Standard Operating Procedures.....	25
Upstairs Layout .....	26
Downstairs Layout .....	27
Results and Discussion .....	29
Implementation plan .....	29
Cost justification .....	30
Conclusions .....	31
Works Cited.....	32
Appendix A: RWL Diagrams .....	33
Appendix B: Facilities Layouts.....	36
Appendix C: Database Design and SOPs .....	40

## List of Equations

Equation 1 .....	11
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## List of Figures

Figure 1 .....	21
Figure 2 .....	28

## List of Tables

Table 1.....	22
Table 2.....	30

## **Introduction**

The project was performed at Company ABC in San Luis Obispo, California. The company has one main facility and two storage units in the area. The main goal for Company ABC was consolidation of their current warehouse in order to cut costs and save money. This report explains the methods for solving this problem, the solutions obtained, and the future plans for the company. The project originated when a former classmate was performing a consolidation with Company ABC for her Master's Project. The Master's Project did not encompass every aspect of consolidation necessary for the company to continue to be profitable. After the Master's Project was completed, the company expressed a desire to continue the consolidation through the use of Industrial Engineering techniques.

The largest issue with Company ABC is their constant disorganization and clutter; it is causing them to lose money. In order for the business to stay afloat, they need to cut outside storage unit costs through decreasing clutter and better organizing their current facility. The manager and employees rarely follow any standards and instead go about solving problems in a manner that seems fit for them. This increases the constant clutter in their space and causes problems if people are assigned to new tasks. The office space is filled with disorganization and clutter that could easily be eliminated. Only three people are using the office space, the desks are extremely spread out, and there is clutter in between. Bookshelves and filing cabinets are scattered about the office, taking up unnecessary space. The clutter upstairs is constantly growing. The lack of organization and control of the space has caused clutter to take over usable space. The clutter is causing the company roughly \$5,000 a year in outside storage unit costs, since they cannot fit this inventory in their current warehouse.

This project intends to achieve two main goals: consolidate and organize the company's current space and remove the need for outside storage units. In order to achieve this goal, the following will be completed in this project:

- Create a vendor database to remove clunky filing cabinets
- Create Standard Operating Procedures for the database
- Remove clutter and organize upstairs space
- Design a layout for the upstairs space to include storage unit inventory
- Design a layout for a downstairs space to put the office (currently upstairs)
- Create an implementation plan for consolidation

Specifications will be collected from the manager and employees in order to understand the facilities design aspect of the project. Alternate layouts will then be created and discussed with the manager. He is responsible for the final decision on which layout will be implemented. A vendor database will be designed in Microsoft Access in a user-friendly manner to ensure ease of use for employees. The database will be designed around the vendor files obtained from the company. The vendor files will provide the constraints to the database along with any specifications the manager provides. Storage units will be inspected and clutter will be organized based on the manager's opinion and the guidance of Industrial Engineering principles. The implementation plan will be completed based on time estimates from the manager as well as quantitative calculations. It will guide the company through the process of consolidating their current inventory, setting up the new database, as well as a system for easily moving inventory from their storage units to their current warehouse.

Anything outside of the upstairs space and downstairs office will not be included in the scope of this project. There are numerous small tasks associated with the consolidation that are not included in the scope. Some of these small tasks include but are not limited to: selling and junking inventory, running meetings to teach standardization and safety, inputting vendor files into the database, and finding new office equipment and storage solutions for the downstairs space.

The remainder of the report will continue as follows. Next, is a section explaining background information on Company ABC and their current state. This is followed by a literature review on topics of consolidation, ergonomics, and database design. Discussion on the design, methods, and solutions to the project then follow. Finally, the report ends with conclusions and future plans for the company.

## **Background**

Company ABC is a home development company based on the Central Coast in California. The company is a small business employing less than fifty people. The company buys shutters, shades, blinds, draperies, closet and garage organizers, and concrete treatments from suppliers. Then the company is hired by homeowners to customize their home through the use of the supplied products. They customize garages, closets, and more. The company provides their service to numerous customers with different homes. This highly customizable business leads to excess inventory. In the situation that the material is customized and not used, it is difficult to find another project needing the same customized pieces.

The highly customizable nature of the service has caused mass amounts of clutter in the Company ABC's warehouse. The company is usually short-staffed and has little time to spend organizing the inventory that piles up. The previous Master's Project aimed to reduce this inventory in their warehouse. Though some of it has been reduced through the use of eBay and garage sales, there is still a lot of inventory that needs to be sold. With the company unable to keep up with their growing clutter, other areas of the warehouse are being used to store things. The upstairs office has become a home to shutters and shades, and other built up customized inventory. Along with the increasing inventory clutter, the company fails to find time to organize their office space. They have spent little time organizing and removing old files and folders, causing more clutter to build up. This clutter is causing valuable space to be wasted and under-utilized.



The build-up of clutter has caused the company to resort to outside storage units to store excess inventory. The storage units have not been organized in a long period of time and are also collecting unnecessary clutter. The constant clutter and use of outside storage units is costing the company a lot of money and making it near impossible for the company to turn a profit.

## **Literature Review**

This project consisted of two main parts: the organization and waste reduction of the company's current space and the reduction of outside storage space. The main goal was to save the company money and to increase their independence. In order to ensure a successful consolidation, substantial research was done on the subjects of facilities design, waste reduction, and database design. Below is the research organized by its relationship to each project component.

### **Organization and Waste Reduction of Current Facility and Storage Units**

The organization and waste reduction consisted of two main research areas: 5S and its implementation, and other organizational techniques used to reduce waste in warehouses. 5S is a lean manufacturing technique used for reducing waste in a workspace. The first step, according to Peterson (1998) is sorting which involves separating what is needed from what is not in the workplace. After the unnecessary tools are removed, they are eliminated from the work environment. The next step of 5S is to set in order whatever product remains. This includes organizing their leftover tools and inventory in a manner that is easy to access. This involves arranging tools so that the most frequently used are the easiest to find. After organizing, the next step is to shine which involves cleaning and inspecting the areas to ensure they are consistently organized. At the end of each day, the areas should be inspected to ensure they are kept organized. Next, the workstations should be standardized so each procedure is the same. Standardization is a tool to eliminate worker error and ensure the space stays organized and clean. Finally, the practice should be sustained by reviewing standards and

enforcing the methods. Companies can easily increase their available space and reduce injury through the implementation of 5S in warehouses.

According to Gapp et al. (2008), every process cannot be standardized, but the use of standardization techniques will help to enforce organization and reduce overall clutter in the long-term. The implementation of 5S is intended to provide a mechanism for improving the workplace with minimal costs and disruption. The great thing about 5S is how simple and easily understood it is. Most workers can greatly benefit from the techniques and as long as the workers continue to follow the principles, the company will vastly improve. It is perfect for companies that do not have a lot of extra time or money available for investment in their operations.

Other organizational techniques for warehouse control can help companies more efficiently utilize their space. According to Rouwenhorst et al. (1999), it is necessary to understand that the storage unit, the storage systems and the equipment have to be suitable for the products, suitable for the orders, and should not conflict with each other. For a company, this simple statement means a complete re-organization of their current set-up. The storage area should consist of two parts: the reserve area, where products are stored in the most economical way and the forward area where products are stored for easy retrieval.

## **Facility Redesign Upstairs**

The facility redesign upstairs includes removal of unnecessary clutter, bringing the office equipment downstairs, and storing inventory from the storage units in this newly opened space. In order to store materials upstairs, it is vital to consider safety considerations.

According to the OSHA Pocket Guide, the fatal injury rate for the warehousing industry is higher than the national average for all industries. The best way to do this is for a company to prevent injury is to provide general ergonomics training and task-specific training, minimize the need for lifting by using good design and engineering techniques, and lift properly and get a coworker to help if a product is too heavy. A company could easily provide pamphlets for employees on moving product. Careful consideration must be taken for product placement to prevent injury.

It is evident that inventory must be organized well to prevent injury, but when does the lift become dangerous? According to Waters et al. (1994), low back pain and injuries attributed to manual lifting activities continue as one of the leading occupational health and safety issues facing preventative medicine. Not only does organization become important in injury prevention, but so does justifying lifting activities. When is a box too heavy for one worker to lift? How long is too long for a worker to perform lifting activities? What height is too risky for a worker to pull a box from? Preventing lifting injuries can be tricky because each lifting situation is specific and unlike another. The best way to determine how much weight is safe to lift for one worker, is by using the Recommended Weight Limit (RWL) equation. This equation looks at different distance, angle, and frequency factors to determine the maximum safe weight a worker should lift in that specific instance. The equation is beneficial because it is specific to a certain situation and can prevent countless dollars spent on workers compensation costs.

$$\text{RWL} = \text{LC} \times \text{HM} \times \text{VM} \times \text{DM} \times \text{AM} \times \text{FM} \times \text{CM}$$

Equation 1

The RWL equation above starts with a load constant, which is 51 pounds or 23 kg metric. Then, horizontal, vertical, and distance multipliers are factored in based on the distances the worker is from the object. Next, there is an asymmetric multiplier based on the angle the person turns, a frequency multiplier based on how often the lift occurs, and a coupling multiplier based on the location and grip of the hands on the package. Refer to Figure 1 and 2 of Appendix A for more information on measurements used in the equation. If the RWL equation is not continuously used for lifting procedures, employees should be informed on lifting practices. According to Walder et al. (2007), the power zone is the lifting region that is considered optimal by ergonomists extending from approximately standing elbow height to standing knuckle height and as close to the body as possible. Posting an image of the power zone and the danger zone visually shows employees how to easily prevent injury. It is a simple way to ensure safe practices in the work environment. It is still advised that the RWL be used to calculate safe lifts. However if this is too tedious or the company is unable to do this, the power zone image is another useful tool. Refer to Figure 3 of Appendix A for a visual of the power zone.

Though safety is extremely important, so is the flow in the upstairs inventory. To establish good flow, Tompkins (2010) says workstations and departments should be enriched and enlarged to allow the operators to use not only their muscles but also their minds. This means there should be enough allowance in the inventory storage area that workers can figure out what they are specifically pulling quickly and efficiently. In order for this to be the case, aisle ways must be large enough for workers to go in and out without worry. There should be enough space for them to walk freely while looking for the correct product. An organizational system is ineffective if there is not enough space to properly implement it. Without the space

to move, the organization will not be kept in place and the hard work will be for nothing! It is important to provide workers with adequate space and organization. An easier task is sure to be done by a worker, but once something becomes difficult or unsafe, it is rarely completed. The best way to ensure good flow is to speak with employees about their needs and requirements while consulting standard workplace space needs. The combination leads to an efficient design that suits the company well.

### **Facility Redesign for the Downstairs Office Space**

Hudson (2004) says the prices for commercial real estate are not getting any cheaper, and because many companies pay for office space by the square foot, they're looking to maximize the space they can afford. Many companies are finding it necessary to downsize office space to save money. Luckily, with the consistent increase of technology use in the workplace, this becomes a definitive option. A worker only needs some storage space, a desk, a chair, and a computer to get by. All other supplies can easily fit on their desk. So as long as the area around the workspace is not too tight, many workers can be placed in a small space. Recent U.S. projects allot about 64 square feet – 8 X 8 – for a typical office worker, and some go as small as 6 x 6 feet. A 6 x 6 space is relatively small, but employees do not necessarily need more space than this. Though it might seem like a tight fit, as long as the office equipment and materials are organized, employees can get by in small spaces. The first step is to ruthlessly de-clutter and get rid of any unnecessary office equipment. Finally, instead of using floor space, it is vital to use wall space for storage. Hanging shelves and under-desk storage help to minimize the usage of floor space while providing walking room between workstations.

The reduction of waste in office space is beneficial in many ways for the company. What exactly is waste? According to Walder et al. (2007), waste is anything other than the minimum amount of equipment, space and worker's time, which are absolutely essential to add value to the product. The removal of waste is not only beneficial for a company's revenue. Removing waste decreases lead-time, costs, creates better ergonomics and less workers' compensation costs. The company becomes a much safer and efficient environment when waste is significantly reduced. They will become more profitable when they better store their product and more quickly complete a job. Any company could benefit immensely from more customers. This could easily be achieved by having a shorter lead time to complete a job. This is realistic after a warehouse is adequately organized.

It is essential to note the importance of office ergonomics in injury prevention. Though it may not seem like it computer and office-based work, such as customer service work, is a growing occupation that is associated with an increase in Work Related Musculoskeletal Disorders (WMSDs) of the upper extremities and neck, and accounts for 30% of the total injury cases in 2005, according to Robertson et al. (2012). After designing an efficient office layout, it is vital to consider workstation ergonomics in desk design. The difficult part with desk design is that employees generally set-up their own desks. The employees have complete control over the ergonomics of their workstations. Ergonomics training courses help reduce injuries and train employees to ergonomically set-up their workstations. The easiest method for injury prevention is simply to offer basic ergonomics training courses. As long as a manager enforces that employees take the time to read a pamphlet or manual, office injuries can be significantly reduced.

## Vendor Database

The most important part of creating a good database is ensuring it is user-friendly. According to Qian et al. (2010), the difficult part of creating a database is that user operations on a spreadsheet are usually error-prone. Integrity constraints, such as functional dependencies can save user input and protect the data from mistakes. An example of an integrity constraint is the use of auto-completion to prevent entry mistakes. If a user enters in a name of a student, when they get to the grade field, the grade already in the database will pop up as a means of auto-completion. This prevents the user from accidentally entering in the wrong grade and creating double records. When there are double records, there is a long process associated with finding the correct record. Another example of this is upon entry of a record, a box will pop up letting the user they might be making a mistake. Once again this prevents double records and the process of finding the correct record.

In order to protect against error, Standard Operating Procedures (SOP) should be created for users to follow. Though this does not prevent all error, it works well for a small scale. In order for a company to have Standard Operating Procedures that accurately serve their purpose, specific techniques have to be understood. First, it is vital to note that SOPs are useless unless they are followed. According to Cook (1999), standard operating procedures must be followed. Written rules and SOPs are effective only if they are used. An SOP that management does not enforce is not a true SOP and should be eliminated. Leaders define themselves by what they enforce. Enforcement should be educational, providing the opportunity for positive rather than negative reinforcement. One method for reinforcing and institutionalizing rules and procedures is to include them as source material for promotional examinations. If an SOP is impossible to enforce, something



has to change--the organization, its leadership, or the policy. Without enforcement of SOPs, the database error is not reduced. Having standardization does absolutely nothing if it is not followed. The SOPs must be available for all employees to use and the manager of the company must ensure they are followed. Also, a company should have initial meetings for the SOPs to be reviewed. In these meetings, the employees have the opportunity to understand and potentially change the procedures. When employees have the opportunity to evaluate ideas, they are more likely to follow the procedures consistently. Once methods of controlling the standards are put into place, it is important to have basic knowledge on how to write them. They should be as simple and brief as possible, and they should be revised often. While writing the procedures, one should be aware how often the task is done. If it is frequently done, users will likely memorize the procedures and need fewer details. However, if the task is rarely done, include more detailed procedures.

## **Design**

This section will explain the initial designs for each aspect of the consolidation project. It will include the steps necessary to arrive at these designs, as well as company specifications and constraints that helped shape the designs.

### **Vendor Database**

After initial discussion with Company ABC, it became evident that reduction of filing cabinets through the creation of a database would be ideal. The company currently has six filing cabinets that are taking up a considerable amount of space in the upstairs office. Originally, the plan was to remove all filing cabinets to clear space. However, the manager explained that some files need to be kept paper and that only vendor files could be turned electronic. This means that filing cabinets could be cut in half, but all of them could not be removed.

The vendor files are sheets of paper explaining monthly costs associated with different vendors. The difficulty in designing a database for vendor files is that each invoice has different fields. After discussing this problem with the company, they suggested using three consistent fields to create the database: vendor name, job name, and invoice date. If this was to be the case, the company wanted to scan the vendor file into the database and link it to the record. This way, when the database is searched for a record, the scanned invoice would pop up, displaying all relevant information.

The company wanted the database to add and remove vendor files easily through scanning the invoice and entering data. They also wanted the ability to remove vendors when they were no longer relevant anymore. Sometimes the company has vendors that they do not

use anymore and therefore it is useless to keep the vendors in the system. The company has roughly six or seven active vendor files for window coverings that they consistently use. They also have roughly two to three for closets, five to six for garage, and twelve to fifteen for miscellaneous things such as electricity and insurance. The database is therefore not needed for a significant amount of data storage. Initially, the design included embedding a scanned vendor file as part of the record in the database. This seemed excusable since the database will include so few vendors. However, fewer vendors do not indicate few records since each vendor may have a file associated with every month of the year. Therefore, it was decided that a hyperlink to an outside storage folder would be created in the record in the database. Upon click, the scanned invoice will open in another window, leaving the database free from being bogged down by large scanned invoice build-up. This leads to a faster, more efficient database design.

The first part of the database is the home screen (Refer to Figure 1 of Appendix C). Notice the links to add, remove, and search as requested. If the add record hyperlink is clicked, the user will be sent to the “add record” page (Refer to Figure 2 of Appendix C). Here all fields must be filled out before hitting go to add a record. If all of the fields are not filled out, the user will receive a notification to fill out all fields. Once the go button has been clicked, there will be a notification that the record has been added. Clicking on the remove record hyperlink on the homepage will direct the user to the “remove record” page (Refer to Figure 3 of Appendix C). Once again all fields must be filled out to remove a record. It has the same notifications as the “add record” page. Clicking on the remove vendor hyperlink on the homepage will direct the user to the “remove vendor” page (Refer to Figure 4 of Appendix C). Here they simply add the vendor name and click go. If no vendor with this name is found, there will be a notification.

Otherwise, a notification that the vendor has been removed will pop up. The final feature is the search page (Refer to Figure 5 of Appendix C). Here, the user fills out any known fields and hits go. A sub-form will then show the records that match this search. If the hyperlink under the scanned invoice field is clicked, the scanned vendor file will pop up in another window. If the user wants to search again, the clear button can be clicked and the original search page will appear.

## **Standard Operating Procedures**

After speaking with the company, it was clear that none of the employees know database design or have used Microsoft Access. Due to this, it is essential to write standard operating procedures for each aspect of the database to ensure proper use. This is a means of error prevention for the database, and for the company itself.

The manager and employees explained that in order for Standard Operating Procedures to be followed, they must be simple. The employees were honest about the fact that they would not spend longer than a minute or two reading the procedures. They would go back and look at the procedures if they had a question, but overall the reading would be limited. The standard operating procedures were designed to be simple, easy to read, and short. The procedures, shown in Figure 6 of Appendix C, take only a page to explain every function of the database. Sentences were shortened after speaking again with management and showing them the initial procedures, but the layout and length stayed roughly the same.

## Upstairs Layout

The manager immediately expressed a desire to remove the office equipment and clutter upstairs to free up space. The goal for the company was to put the office equipment upstairs into a smaller space downstairs where the space would be more efficiently utilized. After further discussion, the option of moving storage unit inventory to the new upstairs space was explained to the company. They liked the idea, and the plan proceeded.

The manager decided that he wanted his office space to stay upstairs, away from the customers. This set-up prevents his time being wasted by customer questions that other employees should be answering. Since he is the manager, he has more important tasks at hand than answering simple questions, so the office upstairs helps prevent this issue. He agreed that removal of clutter upstairs was vital to the consolidation as a whole, and it was estimated that roughly 50% of the clutter could be tossed or sold. The filing cabinets upstairs will eventually be reduced through the implementation of the database. However, until this is implemented the manager wanted to ensure there was space available upstairs for all of the cabinets to be stored. He also wanted to make sure there was space for current inventory that could not be eliminated and needed to be stored upstairs. He did not want to move this inventory because it is rarely accessed; therefore it made more sense to leave it in its current home.

Refer to Figure 1 of Appendix B for the current layout of the upstairs before anything was moved or redesigned. Notice the dark gray areas indicating clutter. One square is roughly a square foot. The current layout includes 160 square feet of clutter that could easily be eliminated or better organized. The white workspaces indicate office equipment that will be

moved downstairs during the process of consolidation. If the equipment does not fit in the new office, it will be sold or eliminated depending on the quality of the product. The purple areas indicate current inventory that cannot be eliminated or moved. It will stay in its current location since it is easier to leave. The gridded area indicates the stairs, which are narrow at only three feet wide. Note that the stairs wrap around so they represent six feet on the layout. Some of the green desks and tables can be removed, as well as some of the orange break room equipment. This is due to the fact that a lot of it is junk and waste. The red shelving below can mostly be removed, though the manager did indicate that he would like to keep one shelf for his own personal use.

Refer to Figure 2 of Appendix B for the proposed layout for the new upstairs space. Notice that there is significantly more room for storage of inventory. Also notice that 50% of the clutter is gone, all of the office equipment is moved, and miscellaneous junk is out of the picture. After the decision to move a significant chunk of inventory from the storage unit to the upstairs of the current warehouse, specific rules needed to be followed in order to decide what could safely be moved upstairs. Two different methods of organization were considered.

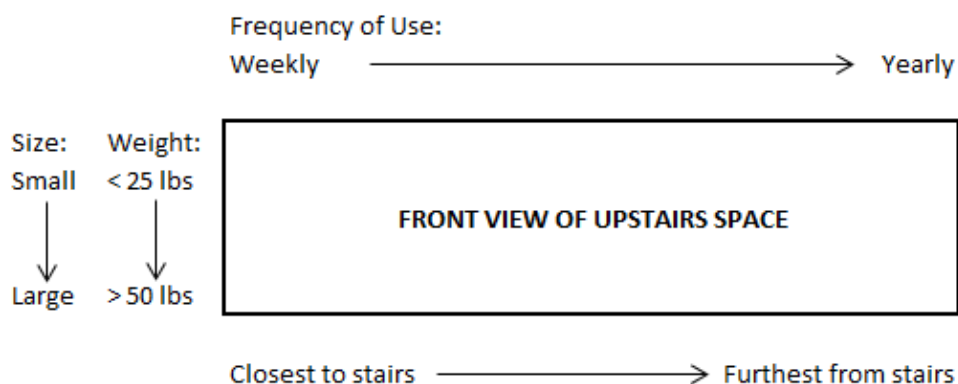


Figure 1

The first method organized inventory based on frequency of use, the size of the box, its weight, and its shape, shown in the figure above. If the inventory was frequently used, it would be placed nearer to the stairs for easy access. However, if it is rarely used it would be placed far away from the stairs since it would hardly be accessed. Boxes would then be sorted by size and clumped together. Therefore, all small boxes would be together, medium boxes, large boxes, etc. If large boxes had a short pile, extra small boxes could be stacked on top. This was only if necessary, and only if the box was smaller than the box it was being stacked upon. Then, the boxes would be stacked based on their weights, with the heavier boxes going on the bottom. An allowance of 50% would be used for adequate space between aisles of inventory. Finally, the inventory would only be stacked six feet high for safety concerns.

<b>Weight</b>	<b>Score</b>	<b>Size</b>	<b>Score</b>	<b>Frequency</b>	<b>Score</b>
< 25 lbs	5	Small (10x12x12)	1	Weekly	25
25 - 50 lbs	10	Medium (14x16x20)	5	Monthly	50
> 50 lbs	25	Large or greater (15x16x24)	10	Yearly	75

**Table 1**

The second method created a score for each category listed in the diagram above. The corresponding score is listed next to the category criteria. The sum of the scores for all categories would determine exactly where to place the inventory. The lowest score would be placed higher up and closest to the stairs. The highest score would be placed in the lowest position and furthest from the stairs. The scores will be sectioned and organized based on the amount of current inventory scored specific numbers. Therefore, the inventory will first be categorized and scored. Then, the range of scores will be considered. Next, the range will be

broken up into sections with the lowest, middle, and highest scores. More scoring categories may be considered. Finally, the inventory is organized based on the scoring method.

## **Downstairs Office Layout**

Upon removal of the office equipment from the large space upstairs, the company wanted to move to a smaller room downstairs. This is beneficial because the office is closer to customers, meaning all the employees can easily be ready for customers to come in. They will not have to wait for the bell and go downstairs when someone enters.

The manager had design constraints for the downstairs layout design. First, the space must have a minimum of two desks, but preferably three. White boards would be needed on the walls for each workstation, just like it is currently set-up in the upstairs space. There should be a front desk with two chairs for customers. This gives a reception desk feel so customers can come and speak with employees easily. There needs to be roughly three to four feet of shelving and two filing cabinets for storage. The spaces for each employee must be no smaller than 5x5, yet no larger than an 8x8.

After research, average office equipment sizing was used to determine what could fit into the small room comfortably. Also, two to three feet clearance was added between all aspects of the design. If any part of the design was not a whole foot, the size was rounded up to ensure available space was not over-calculated. The average desk size for a regular desk was 5.25 feet wide by 2.25 feet deep, while an I-shaped corner desk is on average 3.3 feet wide by 1.7 feet deep. The average office chair size was assumed to be 2 feet by 2 feet, with a two foot clearance around. Instead of allowing for floor storage, wall shelving was suggested to increase



useable floor space. Filing cabinets were still shown in the design, because they are necessary and must be stored on the floor.

Refer to Figure 3 of Appendix B for the first office layout that was created. Each square represents roughly one square foot. Notice there are small corner desks and no employee repair station. The benefit is that everything fits in the room without much clutter. The second layout has bigger desks instead of the small corner desks. However, this causes much more clutter with the desks. Also, there is no employee repair station in the room (Refer to Figure 4 of Appendix B). The third layout has an employee repair station and a clutter-free desk set-up. However, there is no front reception desk for customers to come and sit (Refer to Figure 5 of Appendix B). The final layout has an employee repair station and a reception desk. However, the room only has two desks for employees instead of three (Refer to Figure 6 of Appendix B).

## **Methods**

This next section will explain the steps taken to arrive at the final design for each aspect of the project. It will include methods of comparisons, company decisions, and the final designs for the project.

### **Vendor Database and Standard Operating Procedures**

In order to effectively test whether the vendor database design and the Standard Operating procedures were user-friendly enough for the team, the design was brought directly to the source itself. The original idea was to find random people, have them use the database and Standard Operating Procedures, and then survey them to score the database. However, after initial thought, it was apparent that this would not be useful for the company itself. In order to determine if the database design was user-friendly enough and the Standard Operating Procedures were understandable, the employees and the manager tested the database themselves.

The instructions given to the employees were to follow the standard operating procedures from top to bottom to add, remove, and search for records within in the database. After every member of the team tested the database and procedures individually, a team meeting was held for suggestions to the database and procedures. There was only one complaint about the database, and that was in reference to the design of the database. A member said that without the use of Standard Operating Procedures in conjunction with the database, the layout was not as intuitive as it could be. As for the procedures, the employees spoke about shortening sentences as mentioned earlier. Overall, the employees were satisfied

with the vendor database and the procedures. Since there were so few complaints, it seemed unnecessary to significantly alter the database. However, the sentences in the procedures were shortened slightly as per employee request.

## **Upstairs Layout**

The methods for picking the final layout upstairs were relatively simple. The first layout was chosen based on the specifications of the manager and other employees. The layout was designed and approved by the manager. A second layout was not needed because the manager approved the first one. Though, the layout could have been designed to be more efficient, it was a perfect fit for the company the way it was.

After deciding upon the upstairs layout, the next step was to compare both methods of inventory organization to figure out the optimal one. First, the two methods were shown to the company during a meeting with the manager and employees. It was immediately apparent that the calculation method would be too complicated for the company to follow along with. They were much happier with organizing and placing based on rules. Also, after considering both methods, it was clear that the calculation method was not very accurate. The numbers were arbitrarily assigned to criteria based on what seemed the most important. However, it was not necessarily a good system of organizing the inventory. A middle score could easily be a large box that should be placed below or a small box that that be placed higher. This discrepancy made this system inaccurate and the idea was tossed. The method of organizing inventory based on size, frequency of use, and weight like explained above was decided upon. The basic rules of where and how to stack made it simple and easy to follow.

After quantifying how much inventory could fit upstairs, it was apparent that roughly 75% of the large storage unit could safely be moved to the upstairs location. This means it will adequately fit up the stairs and it fits the height, weight, and size requirements listed above. If an item is not in a box, it will be placed in a section for objects that are unboxed. The entirety of the small storage unit would fit up the stairs and could be safely moved into the upstairs storage area. However, the majority of this inventory was not in boxes. It was also noted that the inventory in the small storage unit could easily be eliminated and sold, removing it completely. Though this is a possibility, the project continues with the assumption of moving this inventory to the upstairs space. The implementation plan will include time for selling and eliminate inventory in the smaller storage unit.

In order to accurately determine how much weight a single person could lift upstairs, based on the requirements of the upstairs storage space, the Recommended Weight Limit (RWL) equation was used. After calculation, it was shown that inventory lifted at the lowest level should be no more than 24 pounds, while at the higher level it should not exceed 20.5 pounds. This means that anything over 20 pounds should be lifted by two workers. This might not necessarily be feasible, but workers and the manager were notified of this ergonomics requirement. The RWL equation is listed and explained in the literature review portion of this text.

## **Downstairs Layout**

In order to decide which office layout should be implemented downstairs, two phases occurred. The first phase consisted of picking a layout based on which had the least amount of

clutter and fit the most requirements set by management of the company. None of the layouts fit every requirement of the office space for the company. However, the first layout, shown below fit the most requirements from the company while still providing a clutter-free space.

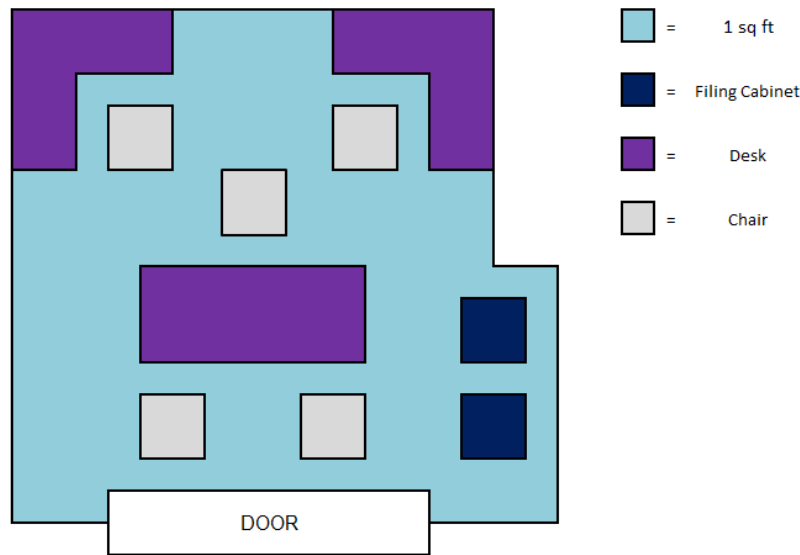


Figure 2

After deciding that the first layout was the optimal office design for the company, the four layouts were taken to the manager and the employees. This began the second phase where the optimal layout was presented to the manager and the employees, but they made the final decision on which layout should be implemented. During this phase, a meeting took place and the layouts were presented to the company. The company was told that the first layout was the most optimal based on their requirements and the reduction of clutter in the space. After a discussion and their viewing of the other layouts, the manager decided that the first layout should be implemented. His decision was not based solely on the fact that it was considered the optimal layout. He decided to implement it because it seemed the most feasible for the company.

## Results and Discussion

### Implementation plan

In order to ensure a quick and easy implementation process for Company ABC, a plan has been created with time estimates listed below.

- De-clutter upstairs space (1 week): This involves throwing away 50% of clutter, removing office equipment, and removing other unnecessary tables and broken equipment.
- Create office downstairs (2 weeks): This involves obtaining correct office equipment, setting up the office, and installing correct storage solutions
- Move employee repair station (1 week): This involves finding a new home for an employee's repair station that was potentially going to have a home in the new office space. There was no room for it, so it must be moved elsewhere.
- Tag and move inventory to new space (3 weeks): This involves tagging inventory in the storage units based on areas where they will be moved in the new upstairs design. The upstairs will have color-coded tags based on the weight, size, frequency of use, and the shape. Then the inventory will be tagged and moved accordingly.
- Enter vendor files into database, shred old files, and reduce file cabinets (6 months): This will take a significant chunk of time since there are so many old vendor files. This

involves entering data for a few hours a day, shredding the files, and emptying filing cabinets. It is not imperative this task be done in a timely manner.

- Sell storage units racks and continue reducing inventory through eBay sales (6 months):  
By slowly selling old inventory online, the company remains anonymous and can slowly de-clutter to eventually create an independent company with no outside storage units necessary

## Cost justification

After reducing the upstairs inventory, clutter, and disorganization, there was roughly 2,256 cubic feet of space opened up for new storage unit inventory to be added. According to calculations below, to empty the large storage unit would require roughly 5,184 cubic feet of space. This was obviously not feasible since roughly double the space is needed to fit the inventory of the storage unit into the current warehouse. However, the small storage unit only requires 1,800 cubic feet with allowance, which will adequately fit into the new upstairs space.

Storage Unit	Cubic Ft Used	Hanging storage	With Allowance	Total Space
Large	3200	256	3456	5184
Small	1200	0	1200	1800

Table 2

With the small storage unit costing \$115 per month, the company will be saving roughly \$1,380 per year by simply eliminating the storage unit.

## **Conclusions**

Through the creation of a database and simple consolidation, the company can save almost \$1,500 per year on outside storage costs. Reducing this cost means the company can spend this money on more valuable things such as organizational systems for the rest of the warehouse. With further consolidation of excess inventory and the potential sales of products within the small warehouse through eBay, the company hopes to get rid of all outside storage. Removing the second storage unit would save the company roughly \$3,000 per year alone. The combination of both will save the company almost \$5,000 per year in outside holding costs. Better utilizing their own space will save the company thousands of dollars, while also improving the business as a whole.



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## Appendix A: RWL Diagrams

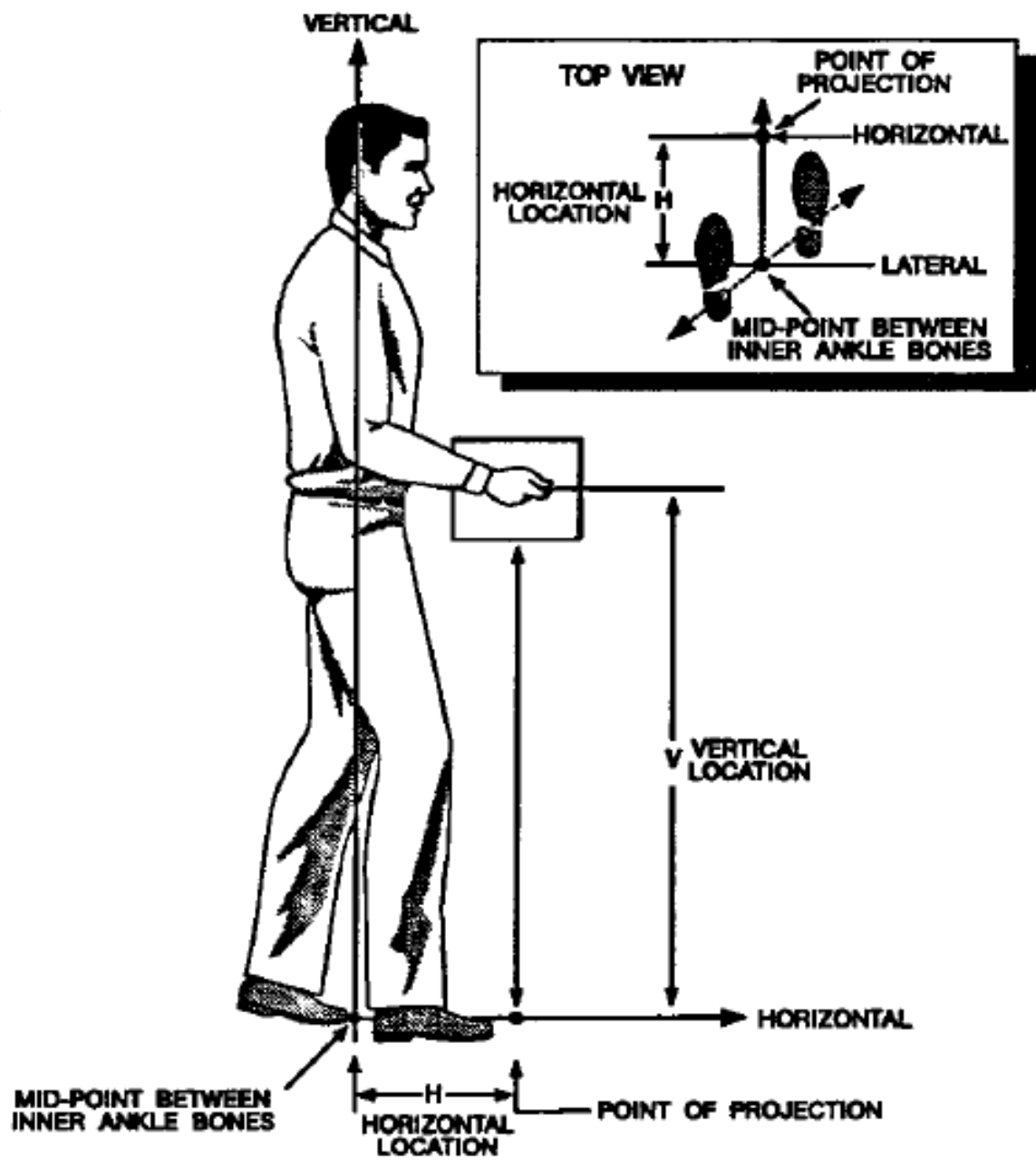


Figure 3

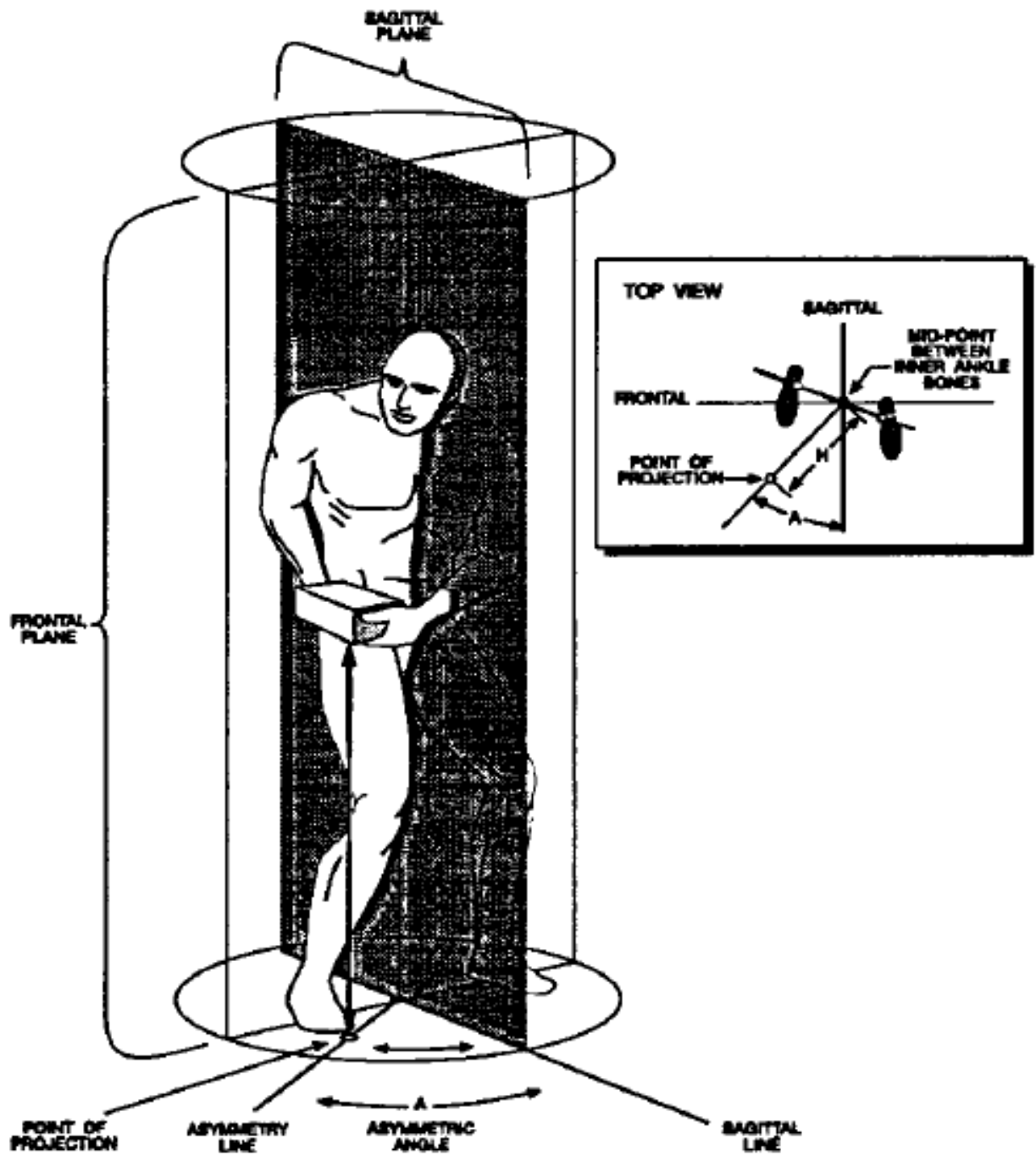


Figure 4

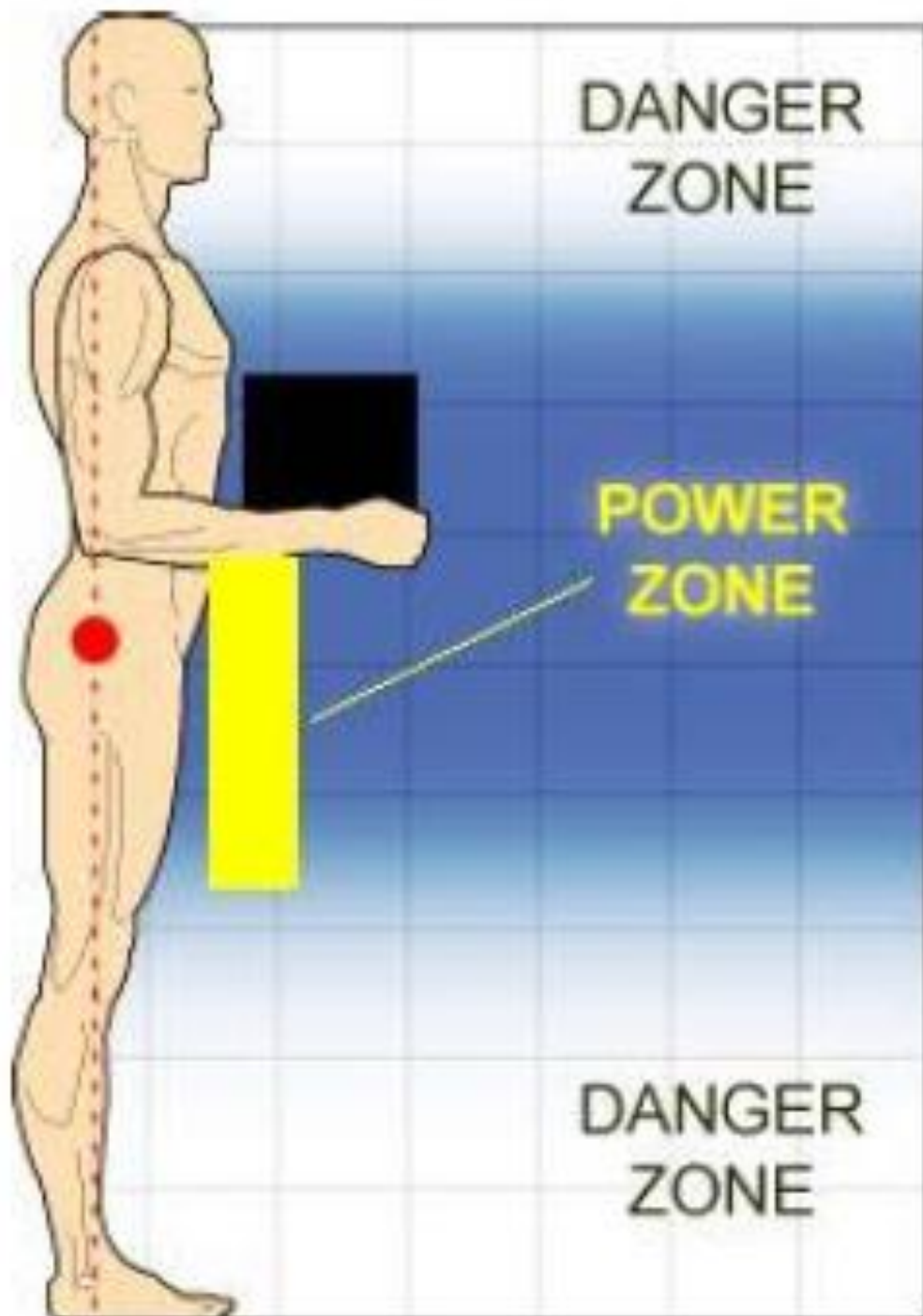


Figure 5

## Appendix B: Facilities Layouts

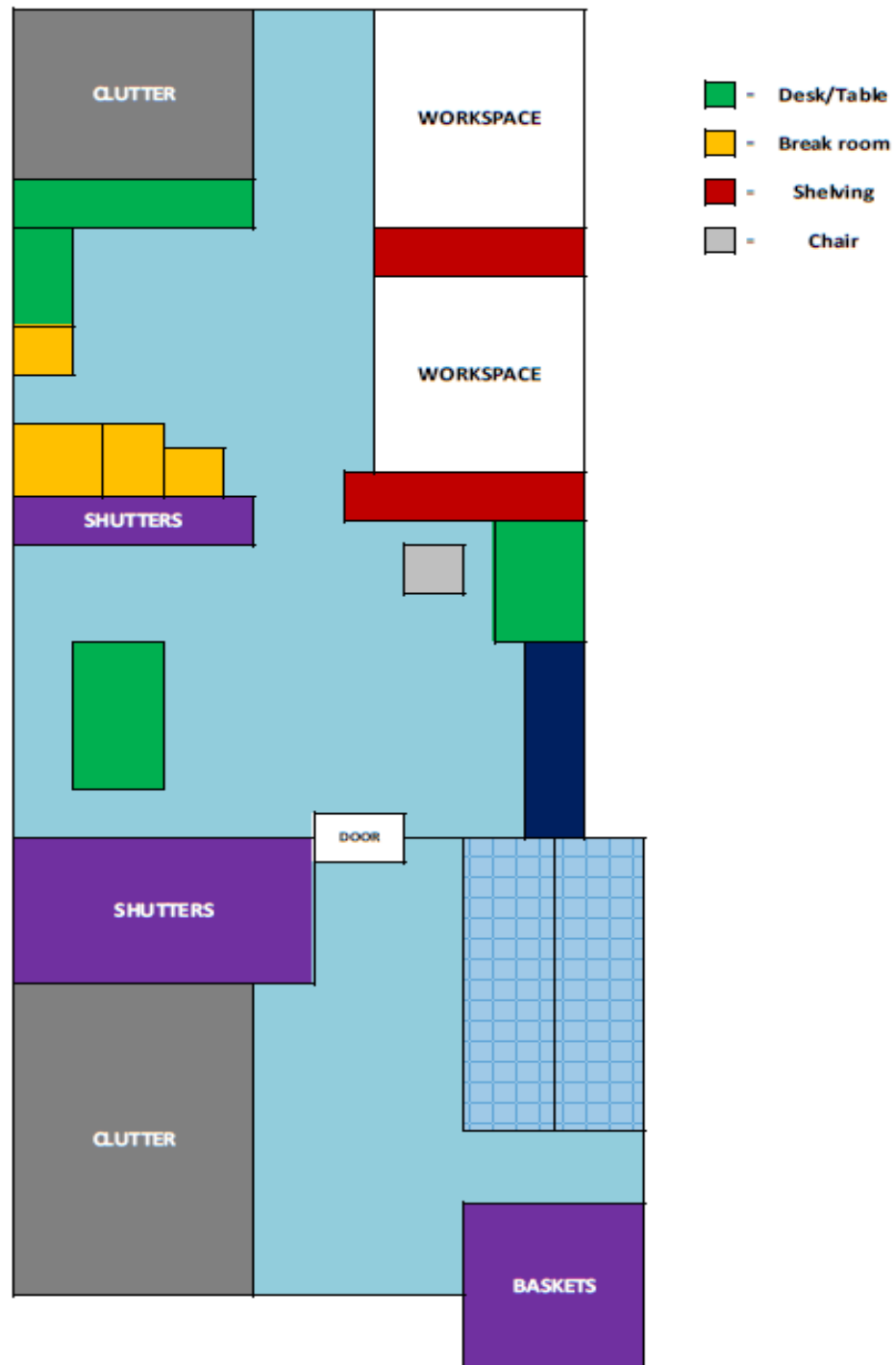


Figure 1 – Original Layout

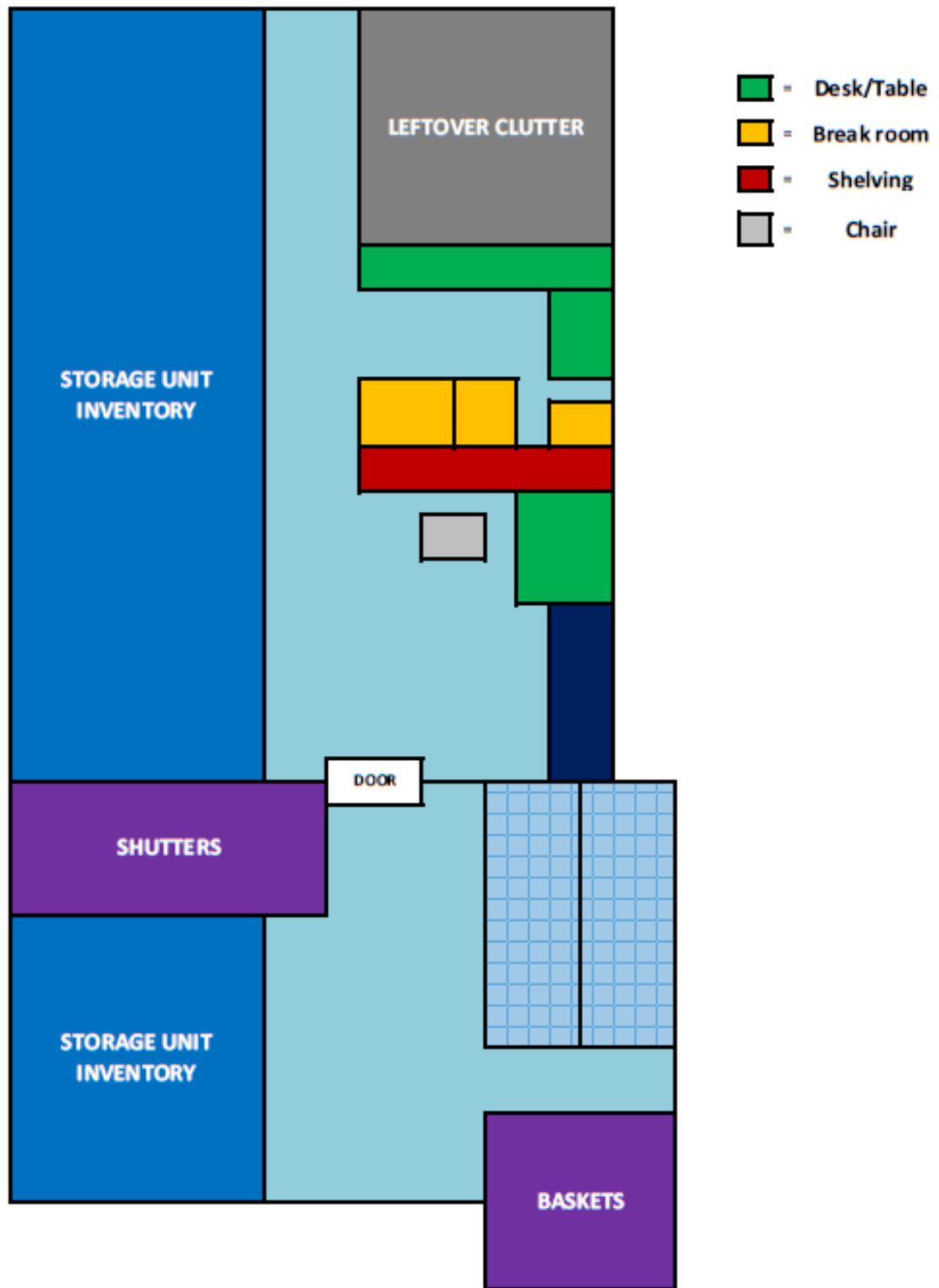
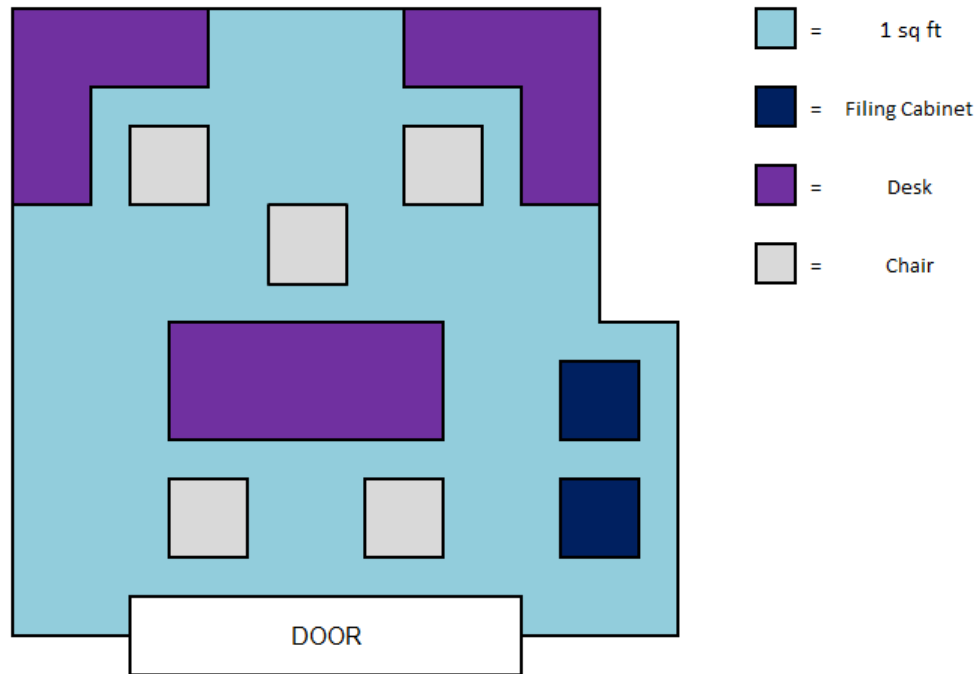
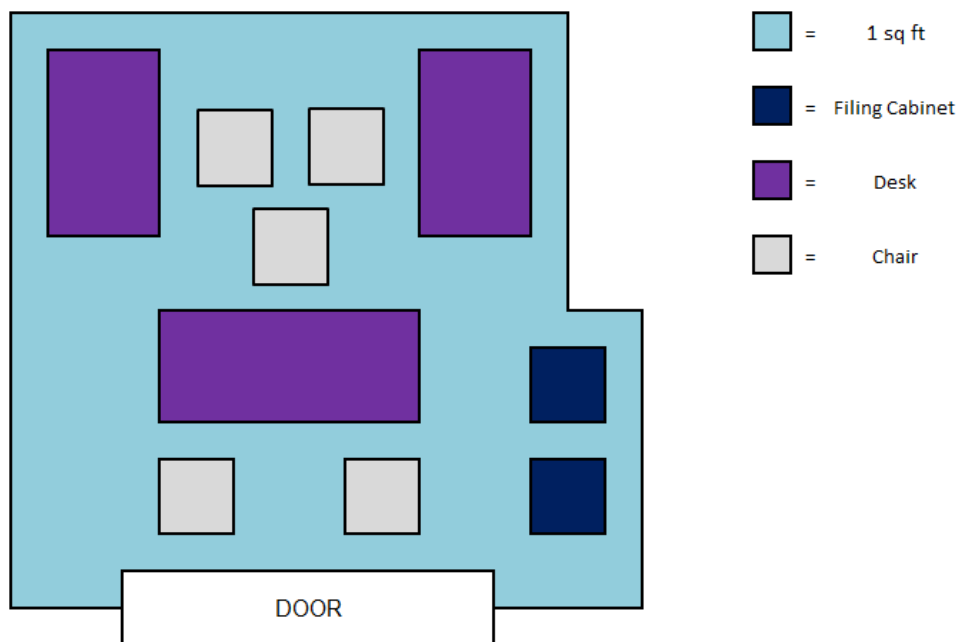


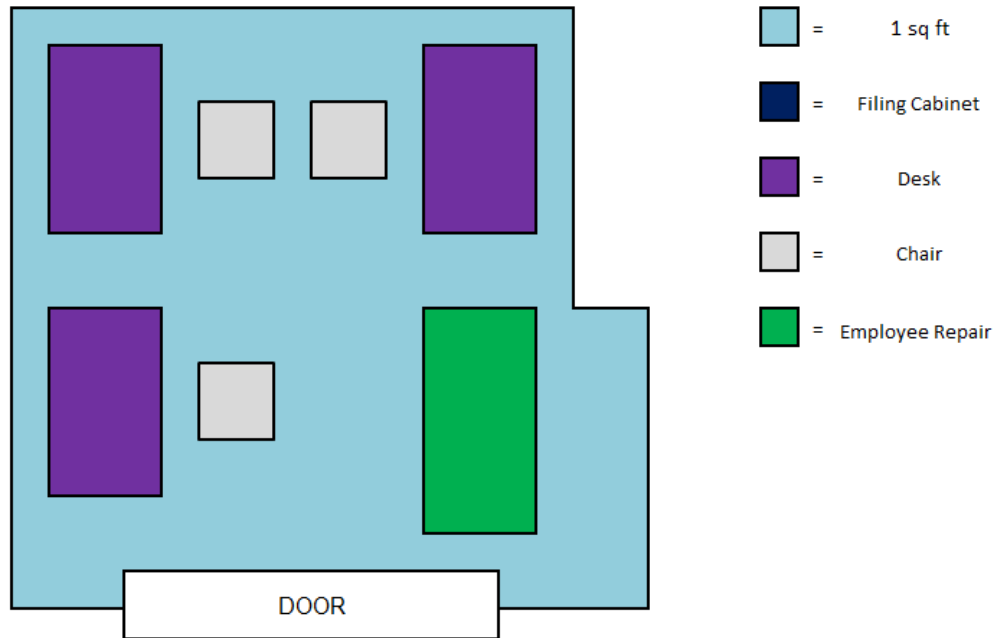
Figure 2 – New Layout



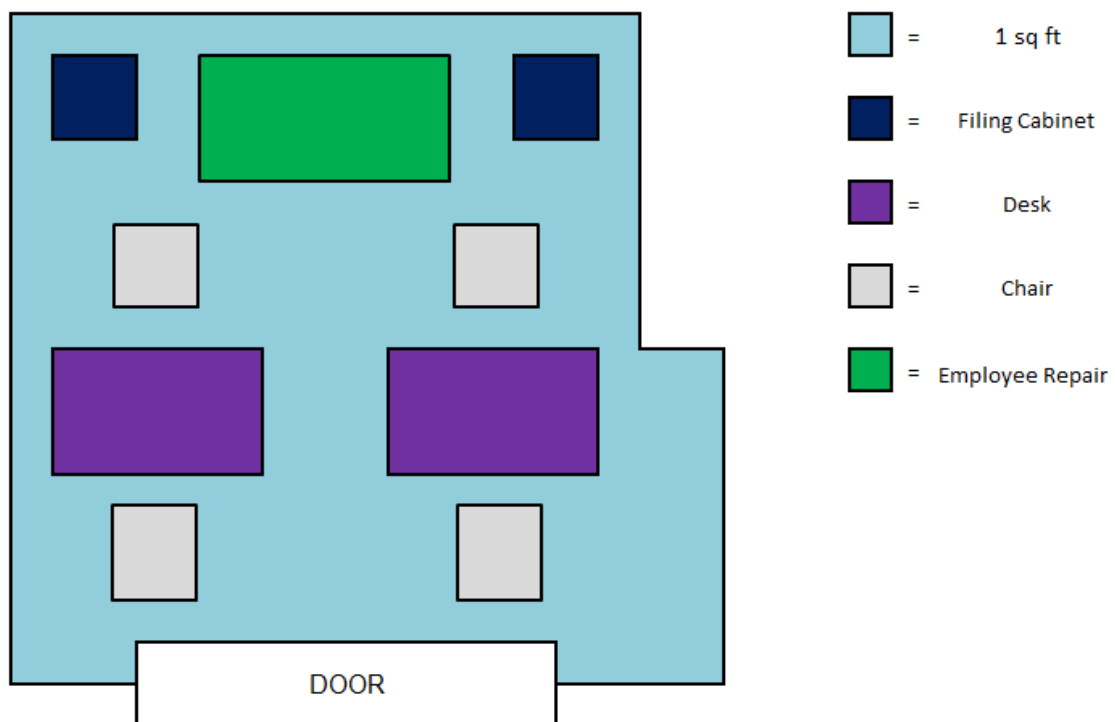
**Figure 3 – Layout One**



**Figure 4 – Layout 2**



**Figure 5 – Layout 3**



**Figure 6 – Layout 4**



## Appendix C: Database Design and SOPs

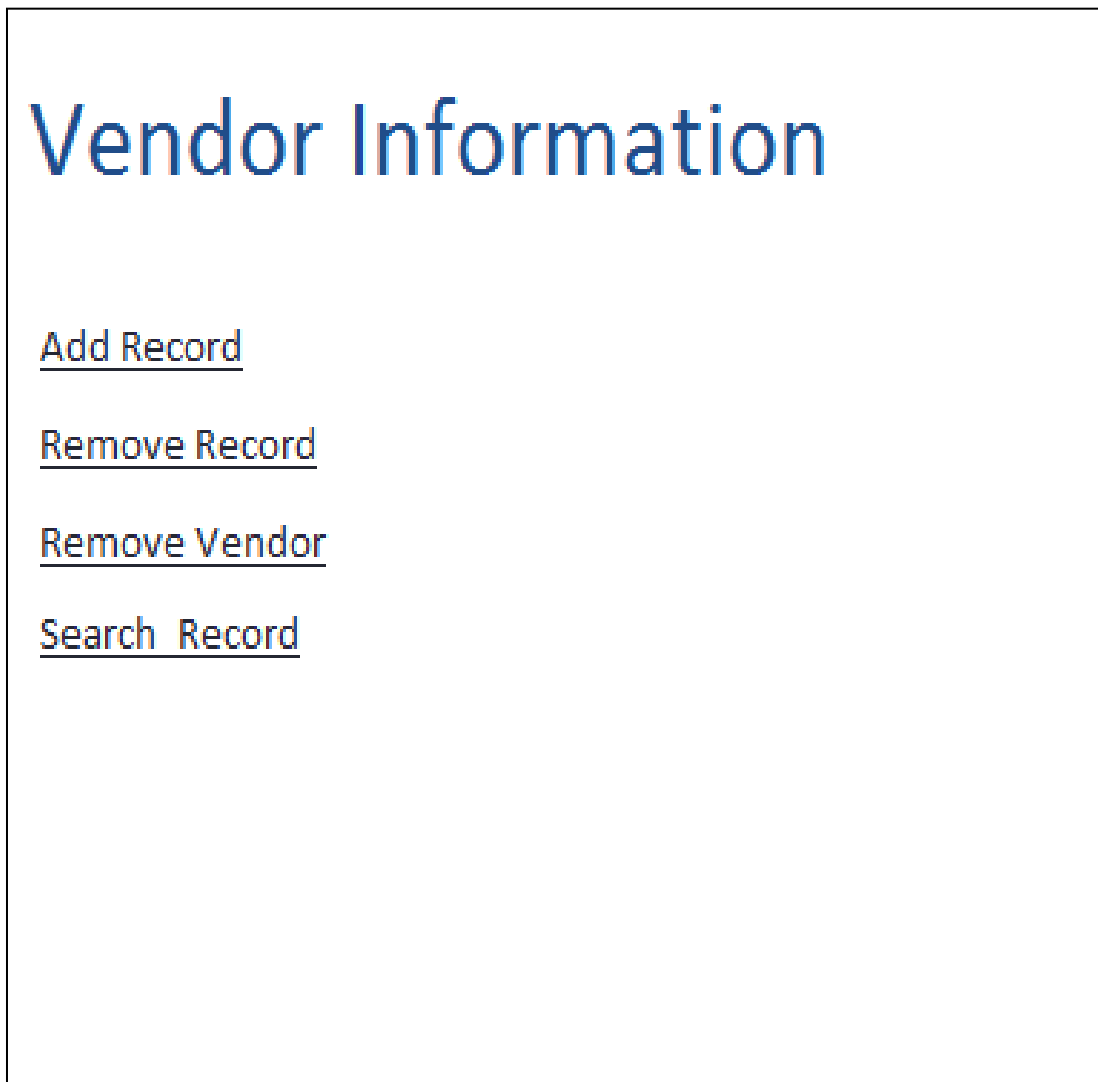


Figure 1 – Home Screen

## Add Record

Vendor Name

Invoice Date

Job Name

Scanned Invoice

[Home](#)

Figure 2 – Add Record

## Remove Record

Vendor Name

Invoice Date

Job Name

[Home](#)

Figure 3 – Remove Record

## Remove Vendor

Vendor Name

[Home](#)

Figure 6 – Remove Vendor

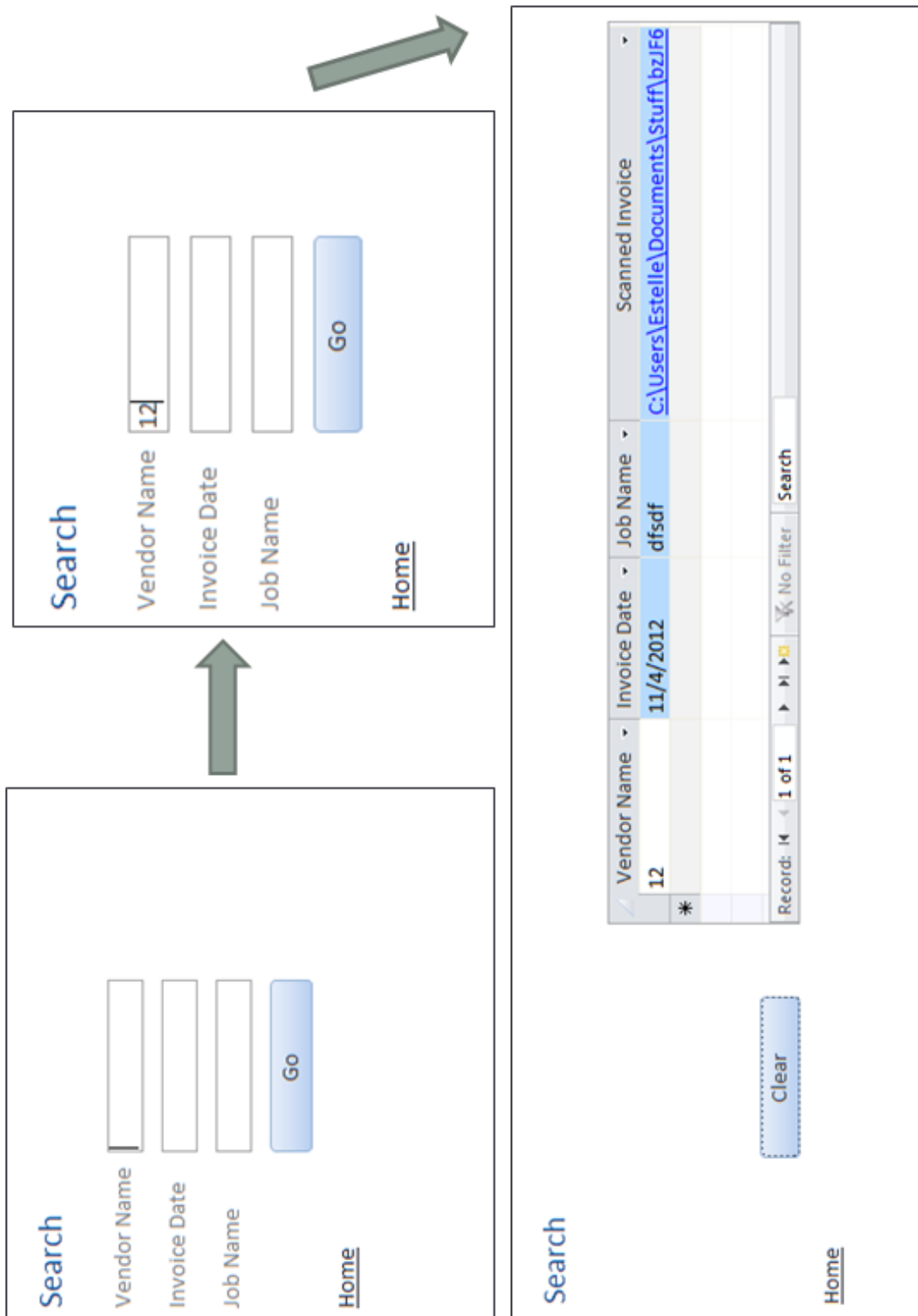


Figure 7 – Search Record

## Standard Operating Procedures for Vendor Files

1. Adding files
  - 1.1 Scan the paper file to the computer
  - 1.2 Save in the location "Vendor Files" under My Documents
    - 1.2.1 Name VendorName\_Date
    - 1.2.2 Date in MMDDYY form
    - 1.2.3 Save as a PDF
  - 1.3 Open the database
  - 1.4 From the home page, click "Add Record"
  - 1.5 Fill out all fields
    - 1.5.1 Vendor name is the company
    - 1.5.2 Invoice date is the date on the paper
    - 1.5.3 Job Name is the person associated with the vendor
    - 1.5.4 Link the record to the vendor invoice just scanned by clicking the field and browsing for the file
  - 1.6 Click the "Go" button to add the file to the database
  - 1.7 Click the "Home" button to do other functions
  - 1.8 Save the database and close
2. Removing files
  - 2.1 Open the database
  - 2.2 From the home page, click "Remove Record"
  - 2.3 Fill out all fields
    - 2.3.1 Vendor name is the company
    - 2.3.2 Invoice date is the date on the paper
    - 2.3.3 Job Name is the person associated with the vendor
  - 2.4 Click the "Go" button to remove the file from the database
  - 2.5 Click the "Home" button to do other functions
  - 2.6 Save the database and close
3. Removing vendors
  - 3.1 Open the database
  - 3.2 From the home page, click "Remove Vendor"
  - 3.3 Fill out all fields
    - 3.3.1 Vendor name is the company
  - 3.4 Click the "Go" button to remove the file from the database
  - 3.5 Click the "Home" button to do other functions
  - 3.6 Save the database and close
4. Searching for files
  - 4.1 Open the database
  - 4.2 From the home page, click "Search Record"
  - 4.3 Fill out at least one field
  - 4.4 Click the "Go" button to see options matching the entered fields
  - 4.5 Click on the hyperlink under "Scanned Invoice" to open the vendor file associated with that record
  - 4.6 Click the "Clear" button when finished with the search
  - 4.7 If more searches are necessary, fill out at least one field and repeat the process
  - 4.8 Click the "Home" button to do other functions
  - 4.9 Save the database and close

**Figure 8 – Standard Operating Procedures**