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Construction Office Design with Systematic Layout Planning

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Abstract

Systematic Layout Planning (SLP) was developed by Richard Muther (Muther, 1961). This technique is presented in many Introductory Production and Operations Management textbooks (Heizer & Render, 2004; Finch & Luebbe, 1995). SLP is a relatively simple process that objectively handles a multi-criteria evaluation process. Recent literature has focused on the use of CORELAP and PLANET for office layouts with few recent, detailed examples of SLP. The case study reported here illustrates the values to a mid-sized construction firm of using SLP. Systematic Layout Planning develops a feasible plan of action through a multi-step procedure. In the progression of working through these steps a great deal of process understanding by those involved results. The company owners and staff were able to develop a vastly improved office layout improving service quality, process speed, and work process understanding. All involved in SLP plan development and implementation discovered aspects of their role and responsibilities and working relationships with others inside and outside the firm. This proven tool for small to medium-sized office layouts is a viable approach for many typical layout and re-layout situations that managers confront.

Construction Office Design with Systematic Layout Planning

Driver Construction Company is a small to medium sized business working in the private and public sectors. The firm was established by its President and Chief Financial officer, Mr. Gerald H. and Mrs. Carol S. Driver. Shortly after completing their engineering degrees the couple married and started a construction business out of their home. Today the firm is successfully competing in both the construction and construction project management sectors. The firm builds high quality, competitive priced buildings. Most often, Driver Construction is building grocery stores, churches, office buildings from one story to 13 stories.

The layout project was an outgrowth of the strategic planning process. During this process the firm set out its objectives for the mid-term future.

To increase annual revenue by 10% or more.

To increase annual profits by 10% or more.

To provide an annual contribution to the company's profit sharing plan.

To achieve and maintain a safety record of no lost work days.

To maintain job security for its work force.

It became clear that one key element to achieving their strategic goals was to become much more efficient in the office. The flow of staff and paper was seen by all individuals working in the office as cumbersome. Files and critical papers were not available in a timely fashion. Project managers and staff found themselves walking the length of the office frequently adding no value to the projects and using time better placed on value added activities.

With the guidance of an outside consultant, the office staff met weekly for one hour sessions for about two months. It was decided that frequent short meetings would allow for the normal flow of work and time to digest and synthesize information from one session to another. These weekly sessions proved invaluable as the entire team discovered aspects of their company that would most likely not have come out in other ways.

Layout Procedures

Layout problems may be solved from a number of approaches. Management science has given us mathematical programming procedures such as branch and bound. There are quite a number of heuristic procedures that are available (Raott & Rakshit, 1993). A few examples are CORELAP, PLANET, ALDEP and CRAFT. We also have available simulation procedures to solve layout problems. The features of these procedures are summarized in Table 1.

Table 1
Features of Selected Layout Procedures

Procedure	Primary Objective	Data Type	Construction
CORELAP	Maximize Closeness	Relationship Chart	Square-shaped departments if possible
PLANET	Minimize Cost	Relationship Chart or From-to-Chart	Square-shaped departments if possible
ALDEP	Maximize Closeness	Relationship Chart	Rectangular strips put adjacent to each other
CRAFT	Minimize Cost	From-to-Chart	No specified shape
Simulation	Maximize Closeness	From-to-Chart	Square Shapes

Adapted from Hassan (1994):498-99.

For the relatively small office layout found at Driver Construction, all these methods were seen as too complex by both management and staff. The administrative staff and leadership wanted a hands-on technique that everyone would understand and be able to participate actively in resolving.

Systematic Layout Planning

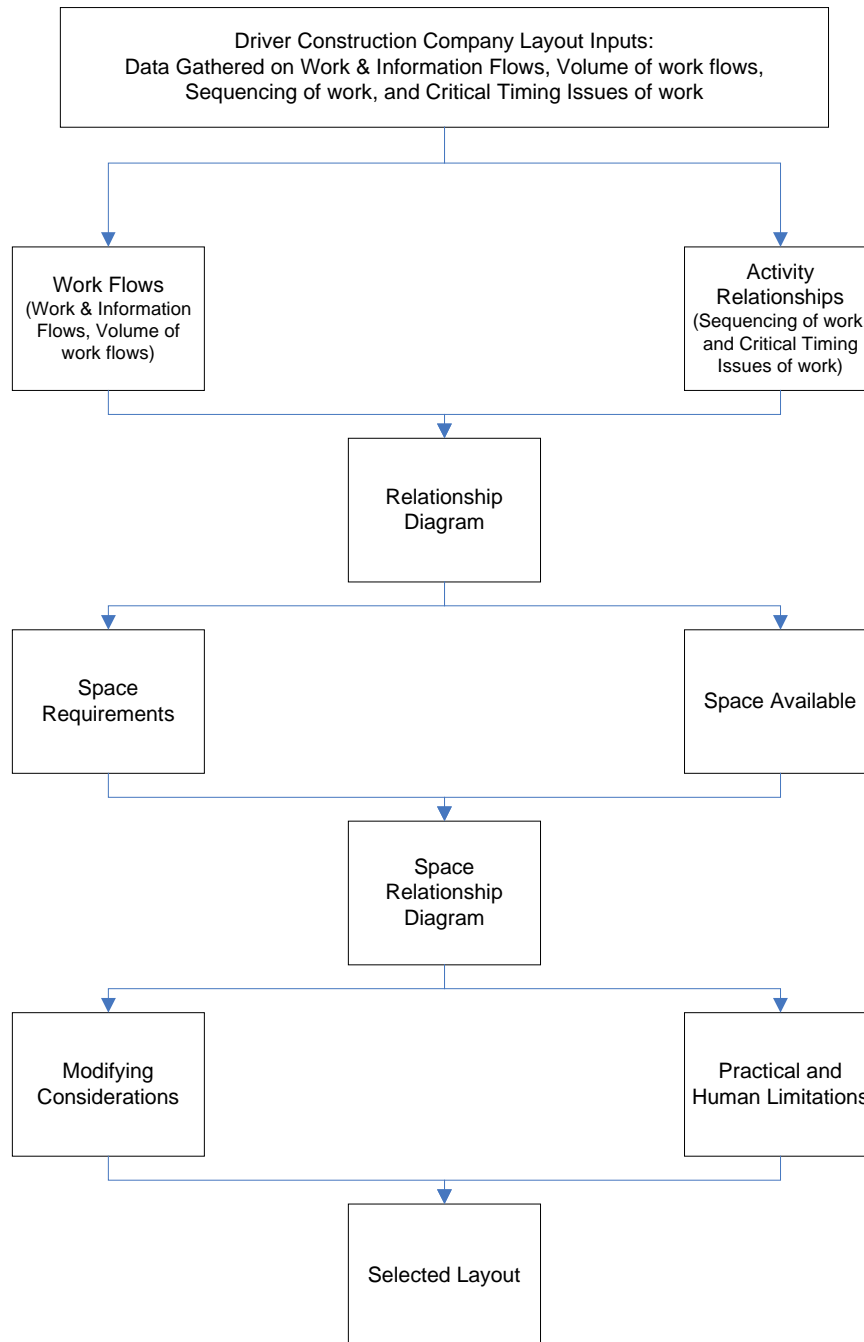
The first hands-on method discussed at Driver Construction was Practical Layout Planning (PLP) proposed by Luxhoj (1990). This method combined layout construction and improvement techniques based on facility location theory. PLP examines both external and internal activity interactions. It was this external-internal aspect that led management at Driver Construction to dismiss the PLP method for this situation as they were only interested in internal interactions.

Driver Construction turned then to Systematic Layout Planning (SLP) developed by Richard Muther (1961; 1973). SLP rests on a foundation of five important pieces of information: material (what is being produced), quantity (volume of transactions), process (sequence of transformation), services required (staff or supplier support), and time (when is output needed) (Muther, 1973). The layout solution process follows a four-stage macro process: location of area to be laid out, general overall layout for area, detailed layout plans (for all offices and equipment in this case), and installation (Muther, 1973).

A six-step procedure was used for the re-layout of offices and equipment at Driver Construction. Following the advice of Muther and Hales (1977) and Mohr and Willett (1999), a plan of action was devised (Figure 1).

Figure 1

Systematic Layout Planning Macro Map



Adapted from: Muther, Richard. *Systematic Layout Planning, second Edition*, Boston: CBI Publishing Company, Inc., 1973, 2-2.

The Layout planning team included the President, Chief Financial Officer, Project Managers, and all office staff. Several one-hour planning sessions were used to develop detailed “as-is” work flowcharts for major office operations. Based on these flowcharts and the detailed knowledge of the operations of the leadership and staff, the systematic layout planning process was initiated. The first activity was developing a detailed activity relationship chart.

Relationship Diagram

Any effective layout needs to start with an in-depth discussion of work relationships. In this case, the primary focus of the discussions surrounded the issue closeness. Each of the major office tasks was listed on the left side of the relationship chart (Figure 2). Each task was related to every other task in the office. In the relationship chart, these closeness values were placed in the corresponding diamond based on the following scale:

A = Absolutely Necessary (to be close)

E = Especially Important

I = Important

U = Unimportant (to be close)

X = Undesirable

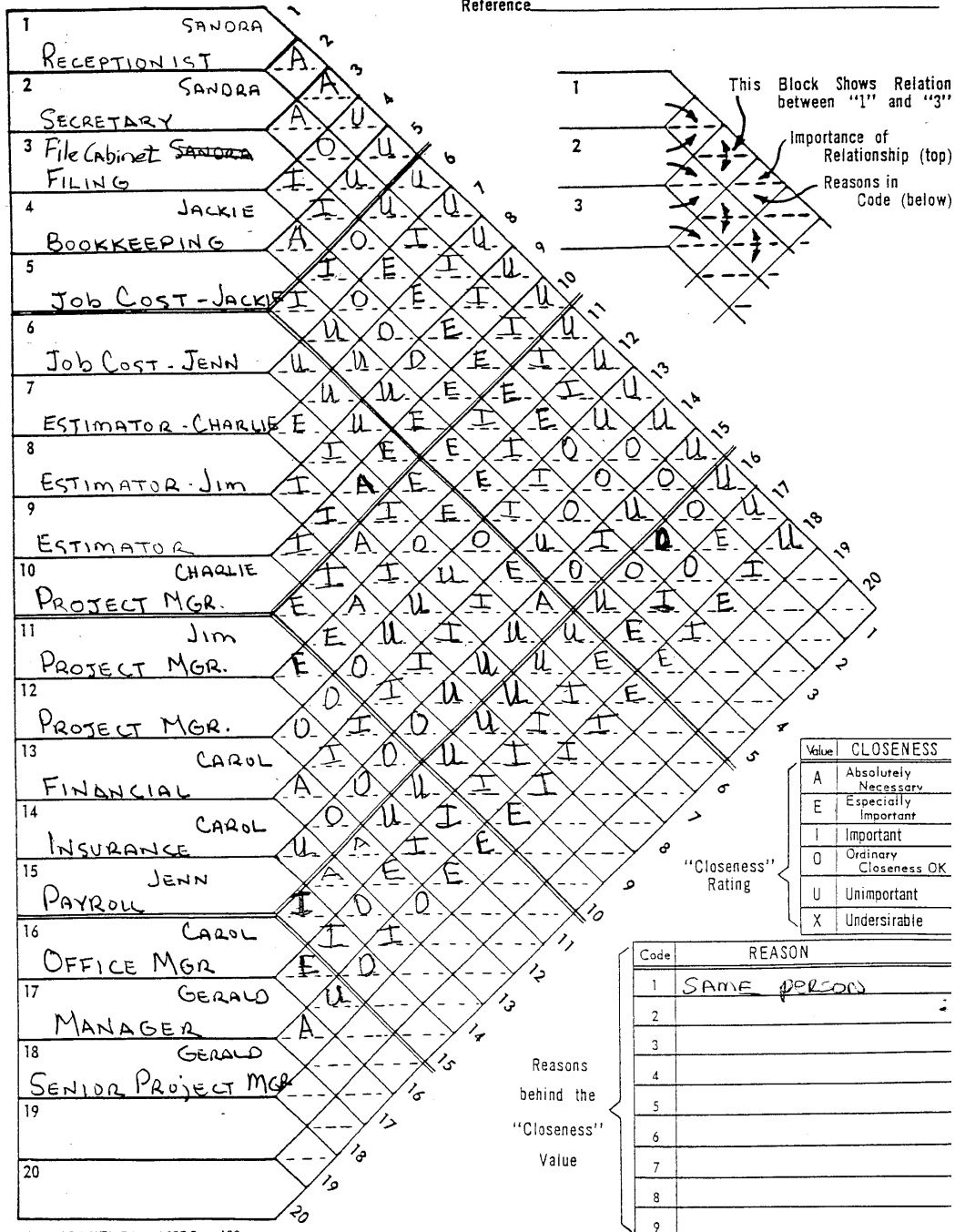
As an illustration, examine the intersection of tasks 5 (job cost) and 11 (Project manager), we see that it is especially important that these activities be close together. While the work of the job estimator (6) and the office manager (16) need not be physically close together.

Figure 2

Relationship Diagram

RELATIONSHIP CHART

Plant DRIVER Project _____
 Charted by _____ With _____
 Date _____ Sheet _____ of _____
 Reference _____



Developing the relationship chart took about 10 hours of meeting time over about eight weeks. During process a great deal was learned about the tasks and roles of each individual by all participating in the layout process.

Space Requirements for People and Tasks

Once work relationships were worked out to the satisfaction of all involved, the group moved on to establishing the space relationships for each individual and their work. Once again, this process was accomplished over a series of weekly, one-hour meetings. Each person listed their personal space needs and these were presented orally and discussed by all. The process of working through this activities area discussion added much understanding to how the business operates now and should operate in the future. Table 2 shows the final output for this process in square feet of space desired for maximum productivity for each person.

Table 2

Physical Space Requirements for Maximum Productivity

Task/Individual	Area in Sq. Ft.	Task/Individual	Area in Sq. Ft.
Reception/Office Asst.	230	Filing Cabinets	80
Accounting/Job Costing	120	Job Costing/Secretary	160
Estimator	192	Estimator	193
Program Manager (Charlie)	210	Program Manager (Jim)	210
Program Manager (TBA)	192	Payroll	120
Office Manager	120	Finance/Insurance	140

Conference Room	196	President/Sr. Program Mgr.	192
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With the closeness relationships and space requirements developed for each major task, the systematic layout planning process continued with the development of the activity relationship diagram.

Activity Relationships Diagram

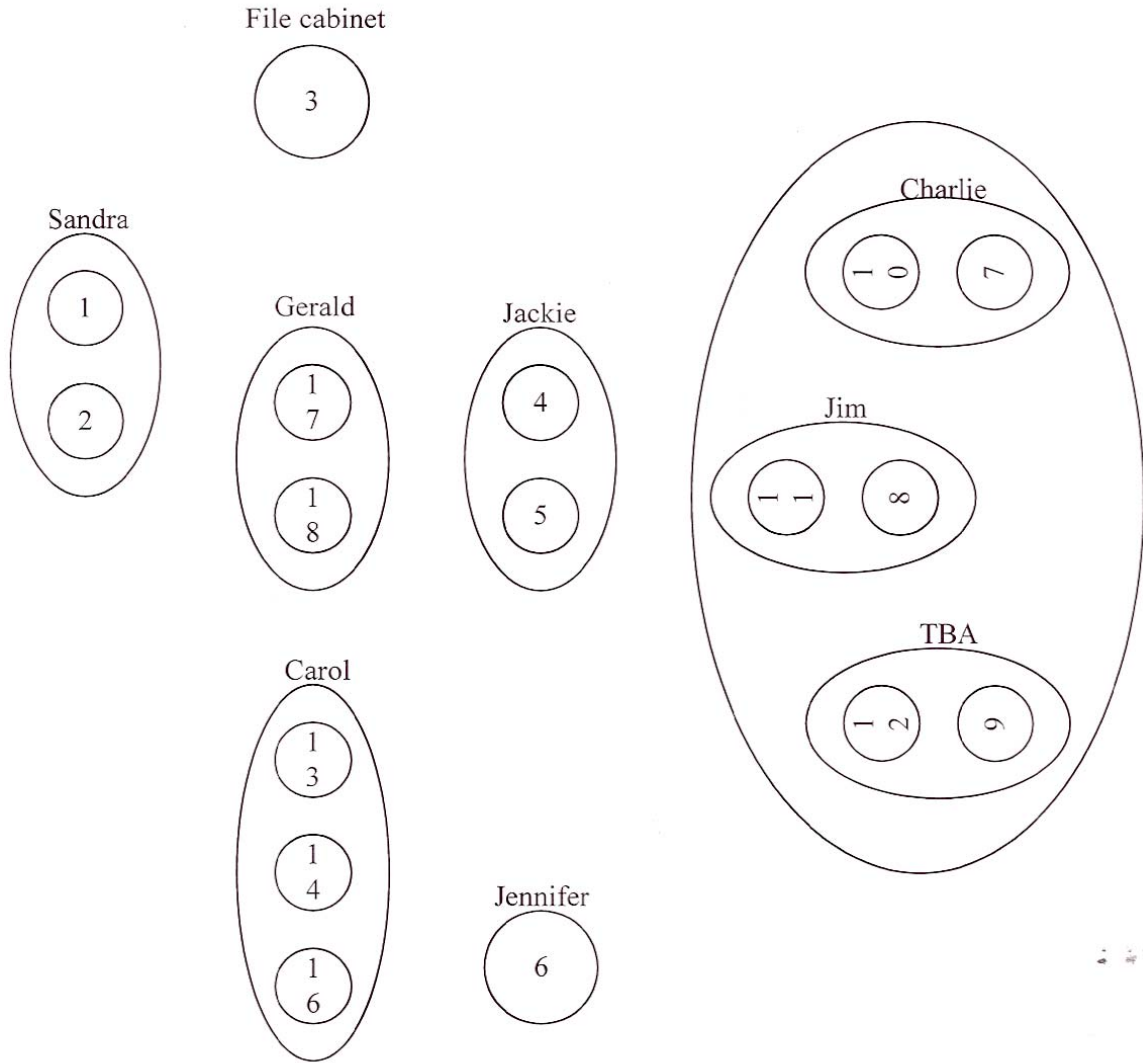
Using flip chart paper for all draft diagrams allowed for easy changes in the activity relationships diagram. With the active input of the entire office contingent the diagram was designed and approved in just five hours over several weeks. The time delay from session to session was very helpful as many times new ideas occurred to people during the week. These insights added greatly to the final layout.

The first task in developing the activity relationship diagram was to bundle jobs based on the individual who performed the tasks. For example, Mrs. Driver is the Chief Financial Officer but also handles insurance and some human resource functions. This bundling of responsibilities is illustrated in Figure 3.

Based on this initial cut of the activity diagram, each activity was related to all other activities based on the closeness value developed in the relationship chart (Figure 3). Four lines between activities indicate that it is *absolutely necessary* that these activities be close together. Three lines show an *especially important* closeness relationship. Two lines illustrate that it is *important* that they be in the same building and floor. In this layout project there were no

Figure 3

Initial Relationships Diagram with Bundled Tasks



situations were it was undesirable to have activities close together. If this situation did exist we would see a line broken with two hash marks indicating this undesirable closeness situation.

Draw Space Relationship Diagram

Using a blank diagram of the office building with walls, rest rooms, and the like indicated, the layout team was able to continue the process of moving toward a more efficient office layout by placing the activity relationship diagram over the existing office structure blueprint. This process took two one-hour sessions to develop. We see in Figure 4 a view of this step with the highest (four line) relationships placed in the center of the space and the lower (two-line) relationships placed around the perimeter.

Final Systematic Layout Planning Design

After several alternative diagrams were discussed and evaluated, the final layout is shown in Figure 5. It was agreed by all involved that this layout is a vast improvement over the previous situation. The systematic layout planning endeavor to this point was considerable in terms of time and effort but well worth the effort. All agreed that communication would be greatly enhanced in the office as individuals and tasks that had highest intensity were not placed together. Often these more communication intensive activities ended up physically right next to each other.

Detailed Layout Plan

The final meetings of the layout team focused on each individual spelling out in detail what they needed to be efficient and effective in their various roles and responsibilities. Every member of the layout team presented and defended their list of equipment. Table 3 illustrates detailed lists for two members of the team.

Figure 4

Final Activity Relationship Diagram

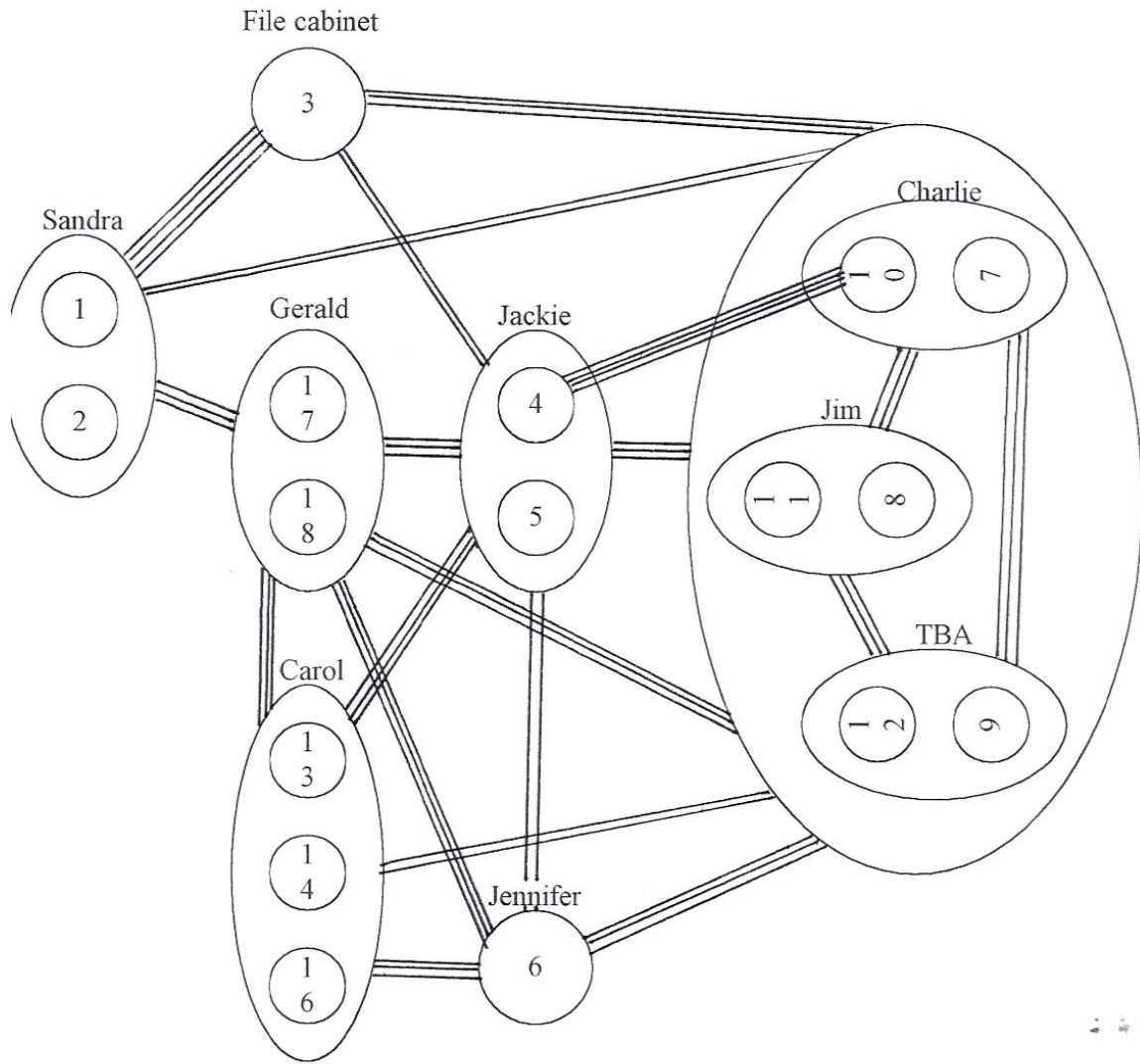


Figure 5

Overlay of Space Relationship Diagram and Office Space Blueprint

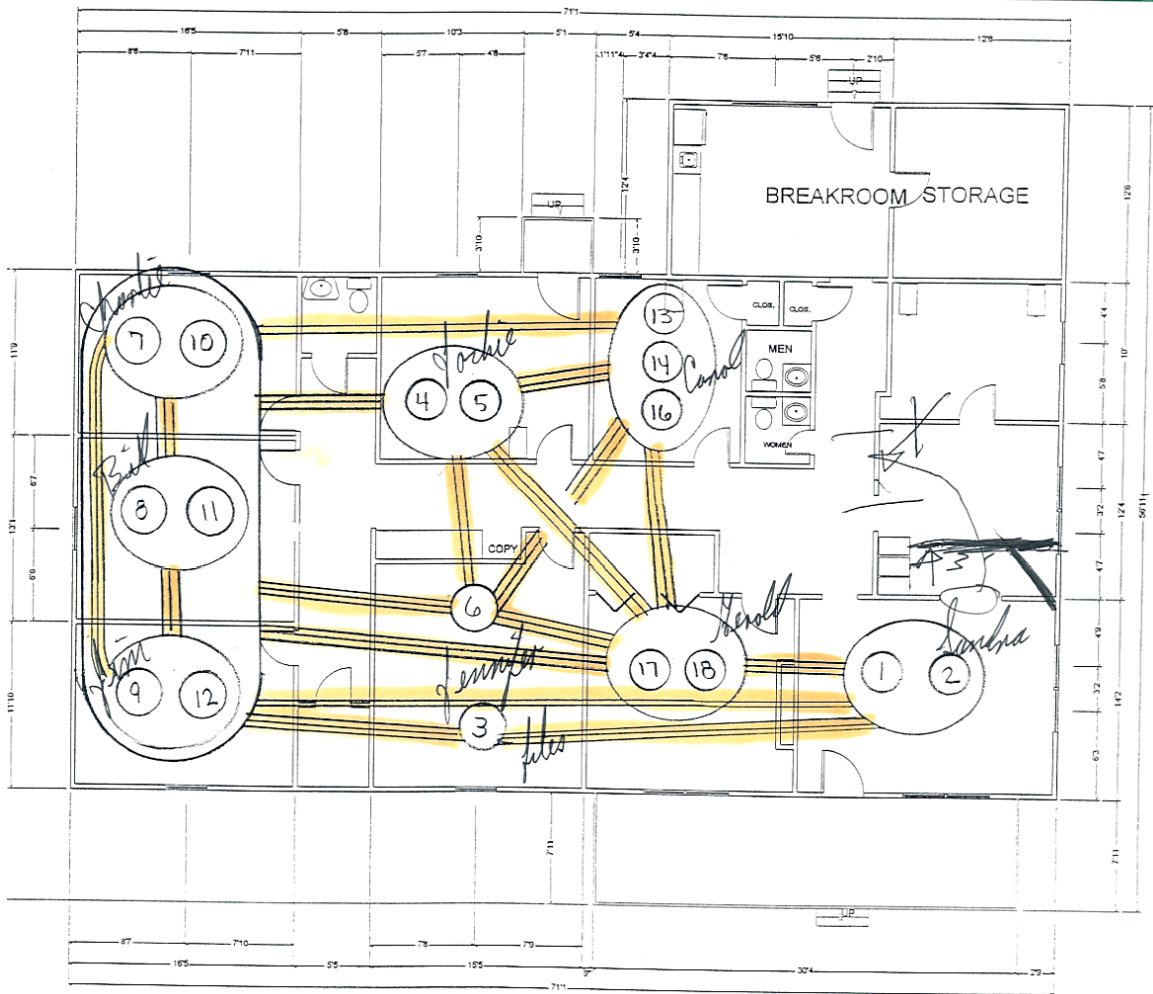


Figure 6

Final Overall Office Layout

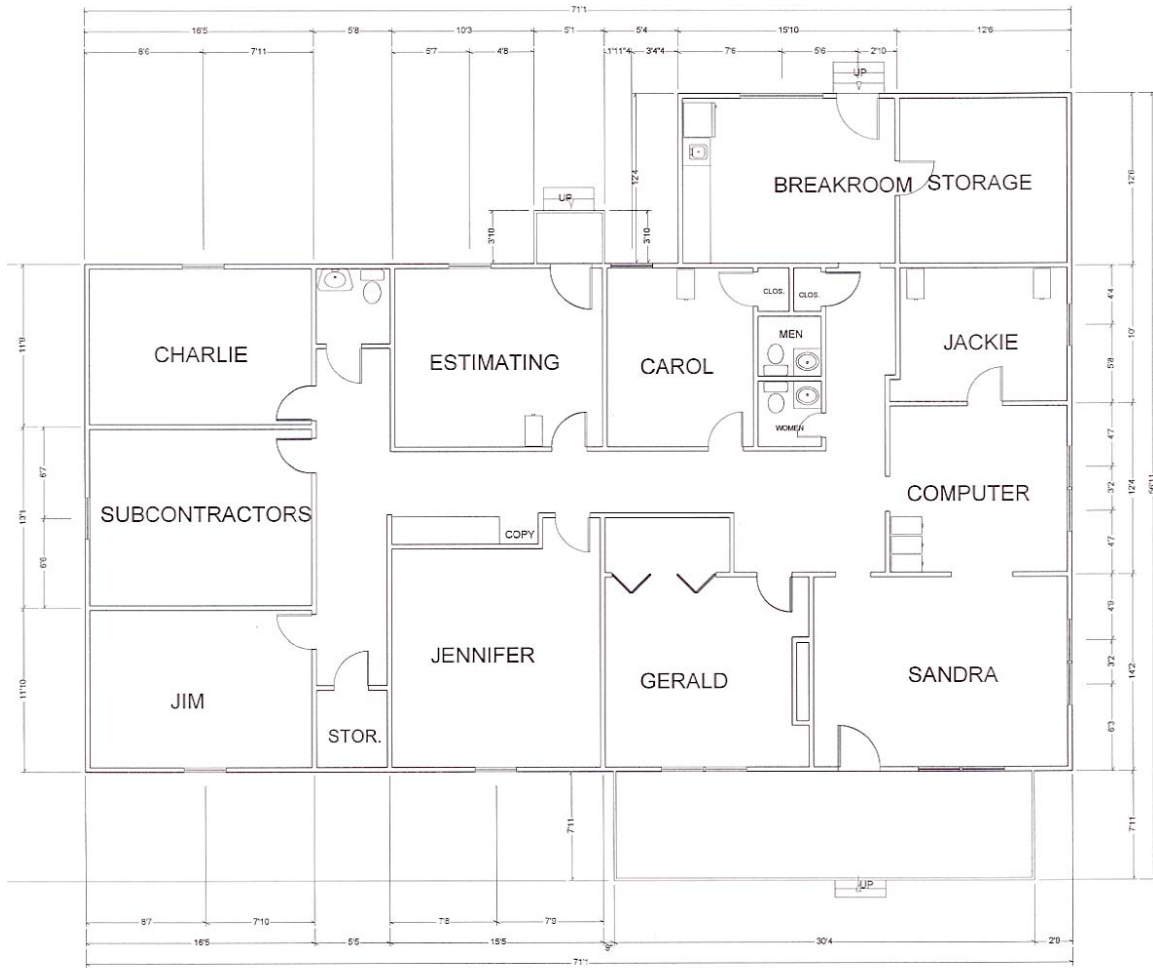


Table 3

Illustrative Lists for Two Functions

Chief Financial Officer	Job Costing
Desktop Computer & Monitor	Desktop Computer & Monitor
Printer	Printer
Desk	Printer Stand
Desk Chair	Desk
Guest Chair (2)	Desk Chair
Fireproof File Cabinet (2)	Guest Chair
Calculator w/printer	Fireproof File Cabinet
Electric Stapler	Plan Holding Boxes
Work Table (36 X 72)	Photocopier

Conclusions

The case study of Systematic Layout Planning at the Driver Construction Company illustrates that small to medium firms can successfully layout and relayout their facilities with this easy to use technique. By combining a series of logical steps that are transparent to the individuals in the firm we achieve a consensus layout. This layout does not completely satisfy all users but does show all why decisions were made.

The Driver Construction Company discovered that the SLP process was as valuable as the final layout. Along the way many aspects of the business previously hidden came to light.

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