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Layout Improvement at Starbucks in Curry Student Center

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Abstract

Rush hours at the Starbucks in the Curry student center are painful for both customers and workers. Customers face long queue times while 6-7 workers cram into a small space and face constant pressure and stress without remediation. This project seeks to improve the layout of the Starbucks and offer other ideas to reduce both time order to and receive them, which would give the customer a better experience and reduce stress on workers. Improvement was achieved by establishing a flow chart, which segmented the project into two different sections: one that focuses on reducing time to receive an order by improving the layout while the other offers alternative ordering methods to traditional ordering to reduce time to order itself, tying into a lean idea of waste reduction. Data was collected on employee's movement between stations and recorded in a to/from chart. The time to order and receive both online and traditionally was recorded as well. The data was then analyzed, turning the employee's to/from chart into a new, more efficient layout with facility layout planning. The difference between the old and new layouts was that the coffee station with pre-brewed coffee was swapped with the oven station, which prioritizes the "especially important" connection between the register and ovens over the second coffee station. It was also found that mobile ordering and the implementation of kiosks, which split the line into 1 + the number of kiosks, is beneficial to all customers and baristas by reducing queue times and stress, tying into the lean concept of automation. While mobile ordering already exists, it should be improved to encourage its use. In conclusion, the Starbucks in Curry should firstly implement the more optimized layout and encourage mobile ordering by either improving the existing application or allowing the Starbucks app to work with the location. If queue times are still too long during peak hours, then kiosks can be implemented as a final, more expensive solution.

Problem Statement

The team has decided to review the system and layout of the Starbucks in the Curry Student Center with means to improve the system's efficiency and effectiveness. Industrial engineers find ways to eliminate wastefulness in production processes and systems. As system integrators, they work hard to improve systematic processes using techniques such as engineering design, systematic layout procedures, process charts, and other applications. Therefore, the problem relates to the operating definition of an industrial engineer because the team seeks to improve the layout system of the Starbucks facility to provide more of an ease to its customers while they are there. The possible benefits would include a quicker, more efficient way for students to obtain their orders amidst their busy days, a safer environment by decreasing possible accidents due to congestion, and the Starbucks workers functioning under less stress and urgency as the environment won't feel as demanding and clamorous. The area most focused on was the layout of the Starbucks behind the counter, while other ideas are explored to reduce the line. The customers of the Starbucks in the Curry Student Center as well as the workers will benefit from these potential improvements as the environment will become less cluttered and more efficient for people to move through the lines, taking stress off the workers.

Analysis

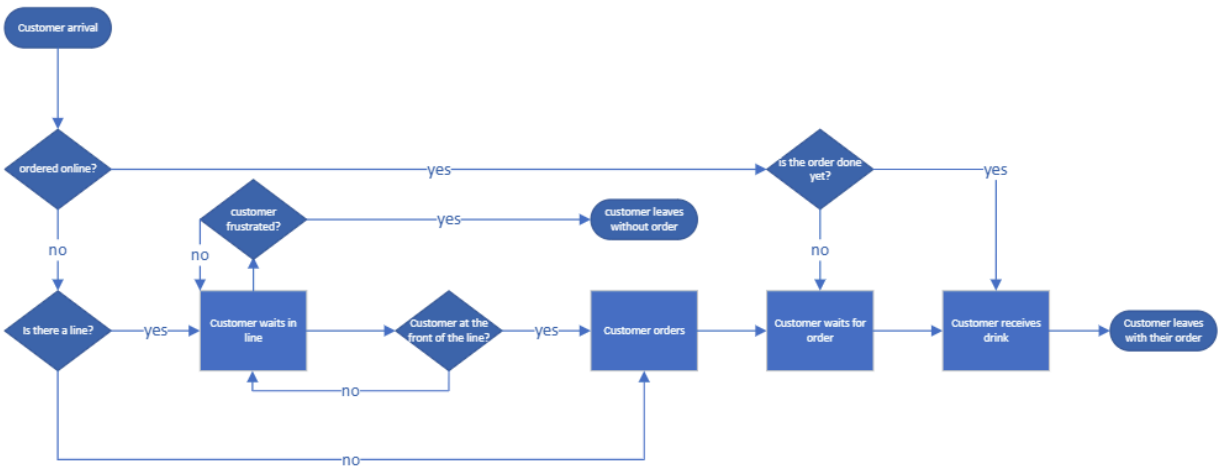

Figure 1: Customer-sided Flowchart.

Before any facility layout improvement can be executed, the root problem, that it takes too long to order and then receive food/drink at the Starbucks in Curry, must be defined. **Figure 1** (above) shows some of the problems that customers face at Starbucks. Waiting in line to order and for orders to finish account for the majority of waiting time. While customers wait in line to order, there is a possibility of leaving because

the line is too long, decreasing business and leaving the customer unhappy. The flowchart shows two possibilities that circumvent the customer leaving without ordering: the first is if they order with boost mobile and the second happens when there is no line. Optimization can thus be realized by encouraging online ordering, decreasing the time to order, and by improving the layout of the Starbucks.

The purported benefits of ordering online must be measured analytically, however, and so data was collected for both traditional and online ordering in **Tables 1 and 2** respectively. Times for traditional ordering were recorded by watching a person in line. Times for online orders were recorded by ordering through the boost mobile app, and both were recorded at around 10:30 am, which is a rush period. Time to order via the mobile app is considered negligible and too different from traditional ordering to consider.

Table 1: Time to Order and Receive Order Data for Traditional Ordering.

	Wednesday	Thursday	Friday	Saturday	Sunday	Average
Time to order	18:31.2	13:12.5	08:30.2	00:00.0	12:29.4	08:44.3
Time to receive order	06:12.8	05:32.2	10:56.6	01:48.4	03:27.8	05:17.1
Total Time	24:42.6	18:44.7	19:26.8	01:48.4	15:57.2	16:08.2

Table 2: Time to Receive Order Data from Mobile Ordering.

	Wednesday	Thursday	Friday	Saturday	Sunday	Average

Time to receive order	6:28.1	04:17.5	04:47.4	04:22.2	05:07.4	05:00.6

When ordering with boost mobile, the total time to receive an order is 11 minutes and 7.6 seconds faster than traditionally ordering on average. This massive improvement can be attributed to mostly not waiting in line, because the time to receive an order is relatively like traditional ordering. Furthermore, employees can plan and space mobile orders out over a period, resulting in more efficiency. The most tangible benefit, however, is that by increasing the number of people who use mobile ordering, the line is reduced (people who would have waited in the line would just wait to receive their order), ignoring induced demand. Thus, mobile ordering decreases the time to order for customers who still decide to order in person. Kiosks can further alleviate wait times by dividing the line up. An estimate of line times for kiosks can be calculated by dividing the average time to order by 1+n (assuming only one cashier, which there usually is), where n is the number of kiosk stations; the overall time decreases with diminishing returns as more kiosks are added. For example, the estimated average time to order with two kiosks is 08:44/(3) = 2 minutes and 54.3 seconds. Both solutions, the encouragement of mobile ordering and the implementation of kiosks, reduce waste; the customers spend less time in line while baristas spend less time taking orders. Combining the two solutions should reduce time to order and long lines that sometimes stretch outside of After Hours.

The other contributing factor to long wait times is the time to prepare and receive the order, which could be decreased with a better behind-the-counter layout so that employees must move less and feel less crowded, resulting in a better work experience and lower wait times. The current layout, simplified for this project, is shown in **Figure 2** below**.** The sizes of stations were unable to be measured, and thus this aspect was omitted from further analysis or discussion, although their relative sizes are examined. Variables that define station names are also noted in **Figure 2.**

Figure 2: Current layout of the Curry Starbucks.

The Curry Starbucks could have as many as 6 employees working within a small area, thus hiring more employees would potentially further increase wait times. Beyond drastically renovating the Starbucks, a facility layout improvement can be considered. To begin, worker's movement between stations was observed. They mostly stayed in the same area or at the same station, with a few exceptions. A to/from chart in **Table 3** based on how many times employees traveled between stations during a 15-minute span was created and filled out. Numbers in table three represent the total trips employees took, taken at around 10:30 am on Sunday.

Table 3: Approximate Movement of Starbucks Employees Between Stations.

TO/FROM	A.	B.	C.	D.	E.	F.	G.
A.	-	28	1	2	3	1	13
B.		-	9	0	0	3	12
C.			-	10	14	8	2
D.				-	12	1	0
E.					-	3	0
F.						-	4
G.							-

Table 3 uses number of travels rather than distance because distance is negligible and less quantifiable during observation. Using **Table 3**, an activity relationship chart in **Figure 3** (below) was created with the parameters: absolutely necessary (A) for 20+ travels (red), especially important (E) at 10-19 travels (orange), important (I) at 5-10 travels (yellow), ordinary closeness ok (O) at 2-4 travels (green), and unimportant (U) at 0-1 travels (white). These parameters are highlighted in **Table 3** as well as Figure 3, according to the colors specified prior.

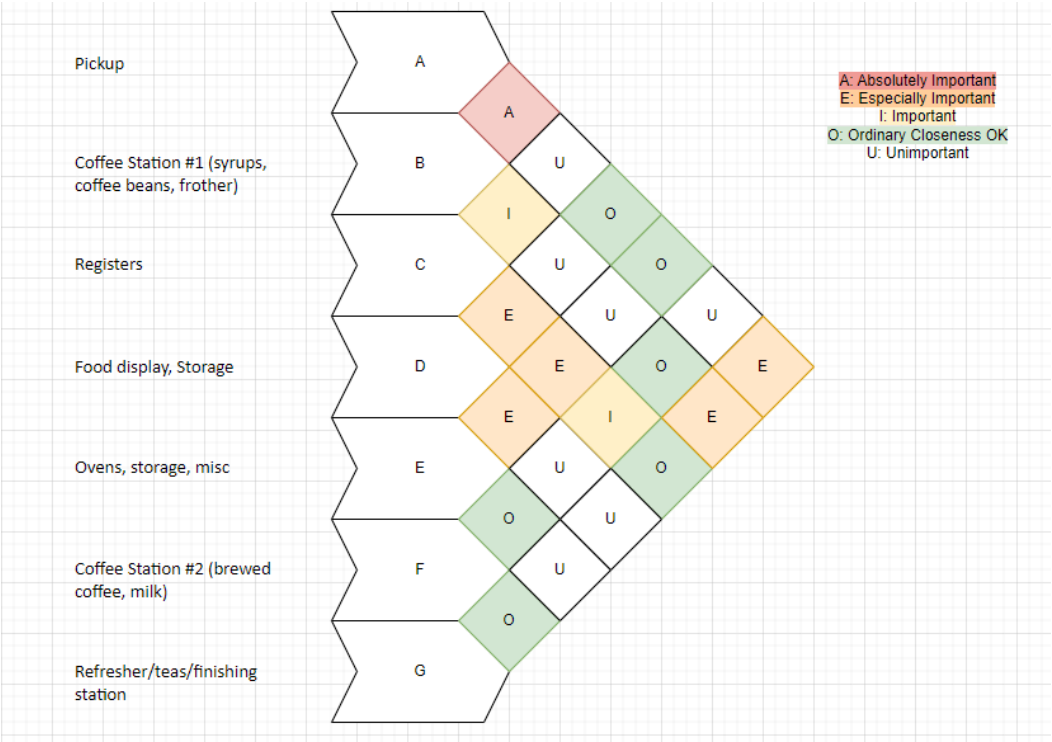

Figure 3: Activity Relationship Chart.

Based on **Figure 3,** an activity relationship diagram in **Figure 4** (below) was created.

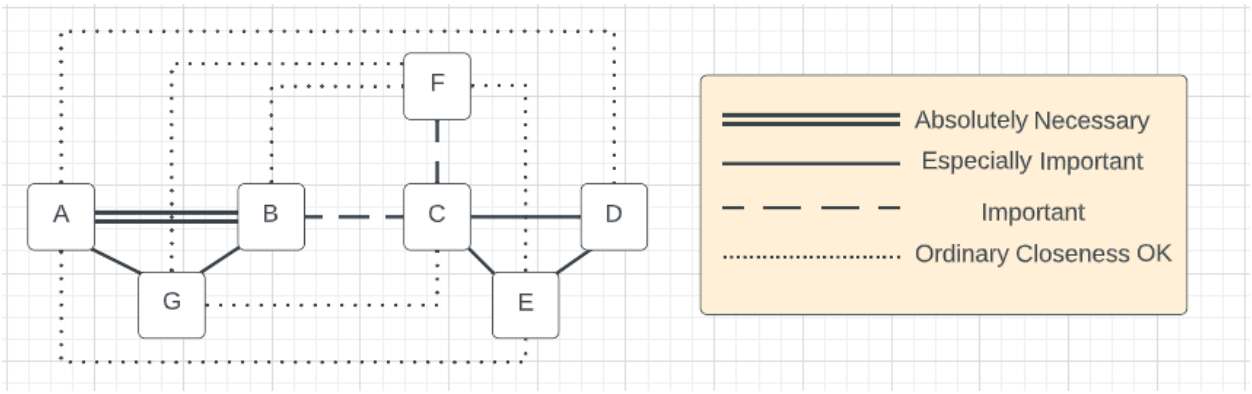

Figure 4: Activity Relationship Diagram.

With the restrictions that the register and customer pick-up must face customers and using the basic outline of Figure 2, a relative space relationship diagram was created using the proportions seen in **Figure 2**, which approximates actual station sizes observed in the Starbucks. This space relationship diagram, shown in **Figure 5** below**,** was created by rearranging **Figure 4** to prioritize important relationships into the basic outline of the Starbucks.

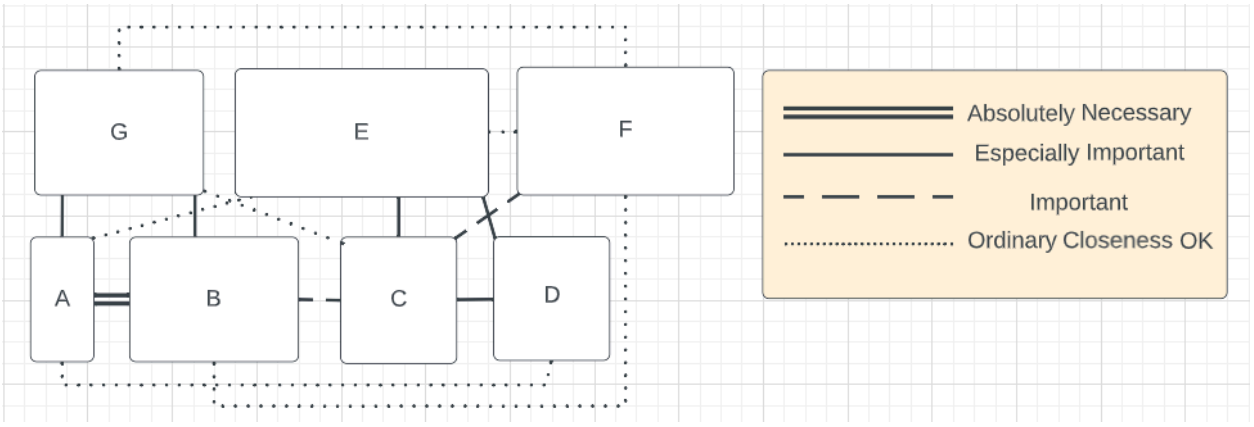

Figure 5: Space Relationship Diagram.

Figure 6, the final, recommended facility layout, is based on F**igure 5.** Constrained by size and the general shape of the current layout, this new layout prioritizes absolutely necessary, especially important, and important relationships. The only achievable difference between the current layout and the recommended layout is that the ovens and coffee #2 stations were swapped, achieving one more especially important relationship while sacrificing an ordinary closeness ok and important relationship. This comparison is shown in **Table 4.** The purpose of the original layout was likely to centralize the coffee machines and cash register (which also makes the Starbucks look better), but this new layout should be more efficient because it prioritizes especially important relationships over others.

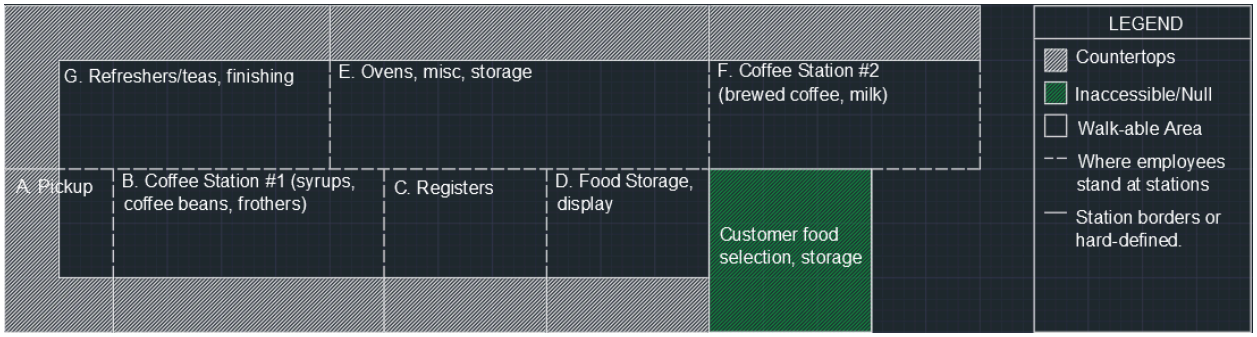

Figure 6: Recommended, Final Layout.

Table 4: Relationship Comparison of Current and Suggested Layouts.

Relationship	Figure 2 (old)	Figure 6 (optimized)
A	1	1
E	4	5
I	2	1
O	2	1

Discussion

Analysis determined that the layout of the Curry Student Center Starbucks could be improved by swapping the locations of the second coffee station with the ovens, which should minimize the distance employees travel and thus, decrease the time to fulfill orders. This was determined by first defining the initial problem, creating a to/from chart, and collecting data to fill it. Based on the to/from chart, an activity relationship chart, activity relationship diagram, space relationship diagram and a final layout were created. Facility layout planning was selected because the Starbucks has too little space with too much demand, which could be mitigated with a better layout. Furthermore, a better layout was simple to model and design because data was relatively simple to collect compared to other methods; the to/from chart was filled by merely observing employees. The reason why the second coffee and oven stations were swapped was because the register was used as a pseudo-pick-up area for cooked food. This presented itself as an especially important relationship, which was deemed more important than the coffee station's (I) and (O) relationships. They were summarily sacrificed in the recommended layout. The increase in efficiency due to overall decreased movement of employees will result in lower times to receive an order. Furthermore, the problem of employees at the ovens swapping to the register, thus interfering with the coffee station, is patched. While facility layout planning was effective at creating a more efficient layout for the Starbucks, this improvement cannot be easily estimated and will most likely provide only a marginal reduction in overall wait times to people who order traditionally because the time to receive an order is low compared to the total time.

Analysis also determined that there were two easy methods to decrease time to order (time spent waiting in line): improving and encouraging mobile ordering and the implementation of kiosks. Kiosks simply split up the line into several shorter ones, but mobile ordering already exists and saves customers 11 minutes

and 7.6 seconds on average compared to traditional ordering. Mobile ordering helps to reduce time to order for traditional customers by pulling customers that would otherwise wait in line into the pickup area; if 50% of customers who order traditionally switch to online, 50% less people would wait in line and result in about a 50% reduced time to order, ignoring induced demand. Less people in line implies less time wasted by customers and employees spending less time taking orders, also granting them the ability to plan order fulfillment ahead of time. Despite the benefits to both customers and employees, most customers decide to not order online.

To encourage mobile ordering, Boost mobile was plastered all over Curry and Starbucks, so repeat customers know about it. They do not use it because there is a learning curve to Boost mobile and it lacks customization, which may encourage or force customers to order traditionally. Furthermore, the Starbucks app, which has a better interface and more customization compared to Boost, does not work with the Curry Starbucks. The comparison between Boost mobile and the Starbucks app can be substantiated by simply downloading both apps and attempting to navigate them. To encourage customers to order online, Boost mobile must be improved and/or the Starbucks app must work with the location. Either solution will significantly increase the number of customers that order online and thus, decrease the number of customers that order traditionally, decreasing time to order.

Kiosks are essentially an automated cashier and can be placed in the store to split lines up, thus reducing time to order. Assuming 1 cashier (typical at Starbucks), n number of kiosks and the same average number of customers as when the data was taken, the average time to order with 2 kiosks could be estimated with avg_time(without kiosks)/(1+n) = 08:44.3/(1+3), reducing time to order to 2 minutes and 54.3 seconds. Both kiosks and mobile ordering can also decrease the workload and stress of workers by automating the cashier's duties and spreading orders out over a longer period. Both improvements tie into lean by reducing wasted customer and employee time through automation.

Overall, the project focused on reducing both the time to and receive orders, with alternative ordering and facility layout improvements respectively and succeeded in finding solutions to both. The unforeseen problem encountered during the project was data collection and quantifying the effect that a change might have. Collecting data for the to/from chart was difficult at times because of how busy the Starbucks was and the nature of observation; customers blocked the view of the shop while many different employees performed many different tasks in a bucket-brigade style environment. Fortunately, the employees remained at their stations for most of the time spent recording data, which kept values manageable. Other data was also difficult or impossible to collect, such as the dimensions of the stations. Estimating the effectiveness of automating the cashier position with better mobile ordering or a kiosk system was quantifiable, however, the improvement to facility could not be quantified.

Recommendations and Conclusion

The goal of this project was to decrease wait times at the Starbucks in the Curry Student Center and produce a few solutions to the problem. The Starbucks, which suffers from rush hour queue times and overcrowded/worked employees, should first begin improving their system by swapping the oven and coffee #2 stations. This should increase the efficiency of work done by reducing unnecessary motion and causing less station crossover, decreasing the time to fulfill orders. Secondly, Starbucks should encourage mobile ordering by either improving the Boost mobile app or by enabling the Starbucks app for its location. Increased mobile ordering takes people out of line, grants time to plan an efficient strategy to fulfill orders and automates the cash register, reducing waste for both customers and employees. Both improvements are relatively easy to implement; the first requires the swapping of adjacent stations and the second can be done remotely. If the line is still too long, then kiosks could be implemented, which split the long line up into multiple lines with shorter waiting time, decreasing time to order. Using collected data and assuming one cashier and two kiosks, time to order can be cut from 8 minutes and 44.3 seconds to 2 minutes and 54.8 seconds. Kiosks, however, are expensive and can take a while to install and implement. Any improvements or changes to the Starbucks should also be done over the summer or winter due to a decreased student population.

The main industrial engineering technique utilized in this project was facility layout planning. It was effective in finding a more efficient layout, but likely improvement in time to receive an order is minimal compared to the much higher total time. Furthermore, Starbucks' current layout was already effective according to the same methodologies that created the new layout. Thus, outside of the box solutions that are tangent to lean, such as mobile ordering and kiosks that automate the cashier station, were also considered in this project to propose resolutions with more drastic effects.

For additional improvements to the facility, the windowsill adjacent to the customer fridge is unused and can be turned into more ovens, storage, food pickup or even a third coffee station; just another station to spread employees out. In the next renovation of "After Hours", they should consider expanding the Starbucks work area, which in conjunction with facility layout planning, would solve a space problem that limited the number of employees to around 6. Although not a facility layout improvement, an employee could be given a tablet and order directly from customers in line. This could either take an employee out of the overcrowded shop area or enable more employees to work and has a similar effect as a kiosk in terms of reducing time to order. They have a lower initial cost compared to kiosks, but a higher long-term cost due to labor.

Overall, the three solutions proposed, an improvement to the layout, the encouragement of mobile ordering, and the implementation of kiosks can significantly decrease wait times at Starbucks and improve customer and employee satisfaction.

References

Data Appendices