

Drive-Thru Queue Study

Orland Park, Illinois

Prepared for
GBC Design

January 2021



INTRODUCTION

This study was undertaken to document the traffic volumes entering the drive-thru and the queue lengths beginning at the pick-up window at a Chick-fil-A restaurant in Orland Park, Illinois. The data gathered was used to compare the existing drive-thru configuration to the proposed configuration of the drive-thru and how the site modifications will impact queue lengths. The proposed configuration can be seen on the site map attached to the end of this report (Map 2). This study was performed during the COVID 19 pandemic when the dining room was closed so all orders were processed through the drive-thru.

METHODOLOGY

The drive-thru study required several types of data to be collected. First, traffic volume counts of the cars entering the drive-thru were gathered from 8:00am – 10:00am, 11:00am – 1:00pm and 4:00pm – 7:00pm on a typical weekday. Second, the queue length starting at the pick-up menu was counted and recorded every 15 minutes during the count times. Third, data was collected to determine how long the average customer takes to order their food at the ordering station (ordering time) and how long a customer waits at the pick-up window to receive their food and exit the drive-thru (pick-up time). The times begin when a customer pulled to either the ordering station or pick-up window and ended when the order was complete or when the customer pulled away from the pick-up window.

After collecting data at the study location, order times and pick-up times were gathered during the same peak hours at a second location with a drive-thru and restaurant layout similar to the proposed layout. The second location was a Chick-fil-A in Lombard, Illinois. The secondary location was determined to be the best alternative in the region for comparison, of how the restaurant upgrades will improve the efficiency that vehicles can be served.

The data collected was used to simulate the existing conditions of the drive-thru in VISSIM 2020 microsimulation software. After calibrating the simulation to accurately depict the existing conditions, a proposed simulation was developed where the order times and pick-up times were adjusted to simulate the improved efficiency provided by the updates to the kitchen. The proposed simulations were used to measure the expected queue lengths after the proposed changes are made to the facility. Table 1 provides the average order time and pick-up time calculated from the data gathered at both Chick-fil-A restaurants. Table 1 also provides the mean order time and pick-up time used in the microsimulation. The mid-day and PM peak mean times differ from the

Chick-fil-A Drive-thru Queue Study

measured averages collected in order to represent multiple orders being taken and fulfilled at the same time, via employees walking to cars, during these peaks. During these peaks, three to four vehicles were served while waiting to pull up or leave the drive-thru. The observed lengths were the main focus in calibrating the models to existing conditions.

Field Measured Times - Average Time						
	Order Times (sec)			Pick-up (sec)		
Site	AM	Mid-Day	PM	AM	Mid-Day	PM
Orland Park CFA	56	62	49	69	21	33
Lombard CFA	49	53	58	44	52	34
Simulation Times - Mean Time						
	Order Times (sec)			Pick-up (sec)		
Site	AM	Mid-Day	PM	AM	Mid-Day	PM
Orland Park CFA	56	18	17	69	20	18

Table 1: Measured vs Simulated Existing Queue Lengths

Table 2 below provides the average order time and pick-up time used in the proposed simulations. Once again, the Mid-day and PM peak hours use a reduced order and pick-up time to represent multiple orders being ordered or picked up at the same time. Table 2 also provides the expected average times that will occur in the field. The expected field times are calculated based on the mean times used in the simulation.

Proposed Simulation Times - Mean Time						
	Order Times (sec)			Pick-up (sec)		
Site	AM	Mid-Day	PM	AM	Mid-Day	PM
Orland Park CFA	56	15	14	69	17	15
Expected Field Times – Average Time						
	Order Times (sec)			Pick-up (sec)		
Site	AM	Mid-Day	PM	AM	Mid-Day	PM
Orland Park CFA	56	45	41	69	18	30

Table 2: Measured vs Simulated Existing Queue Lengths

DRIVE-THRU QUEUE ANALYSIS

Based on the current restaurant layout the available queuing distance within the site is approximately 760 feet from the pick-up window. This distance was measured from the pick-up window to the entrance of the Chick-fil-A parking lot, with a second lane for queueing from the drive-thru entrance to the entrance of the Chick-fil-A parking lot. See Map 1 (Drive-thru Queueing Distance) to see the distance measured. This distance is anticipated to accommodate approximately 36 vehicles on site before impacting the access to other businesses.

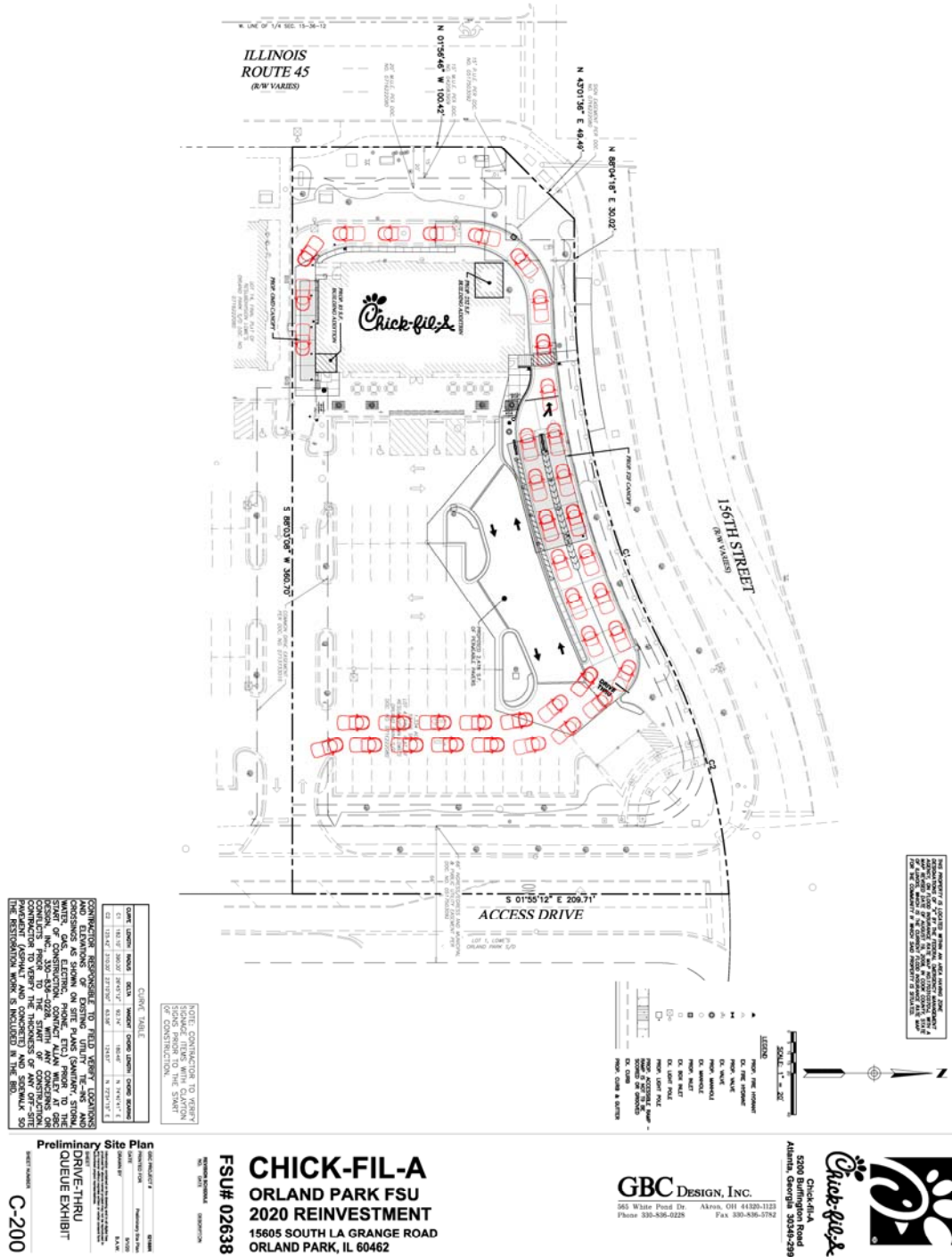
The proposed site plan will increase the queue distance by approximately 60 feet. The new total queue storage length will be 790 feet, which will accommodate approximately 39 cars. Map 2 shows the recommended drive through queue layout and the total number of vehicles that can queue in this space. Additionally, with the improvements to the kitchen area and the addition of a second ordering station the restaurant efficiency will increase; therefore, decreasing the time to order and time to pick-up the food in the drive-thru. This will reduce the maximum queue length at the site. With the queue length reduced and the available queue length increased, all vehicles will queue on site without affecting the entrance to the strip mall based on the simulations.

The data from this study shows that the number of stacked vehicles exceeded the available 36 vehicles during the mid-day and PM peak hours. During that time the maximum number of vehicles at any point of time was 41 vehicles during the mid-day peak. Table 3 provides the average and maximum queues for the existing conditions measured from the pick-up window. The first column provides the queues that were measured in field while the second column provides the simulated queues after calibrating the model. The simulation was calibrated to observed queue lengths. The VISSIM program is unable to simulate multiple orders being taken or picked up at one time; therefore, the average order time and average pick-up time were altered so that the model would match the existing conditions in the field. The concern expressed by the city staff was eliminating the traffic that backs out onto the road, so the maximum queue will be the focus of this study. By allowing the simulated maximum queue to be slightly longer than the measured queue, the analysis provides conservative results.



Map 1: Existing Drive-thru Queueing Distance

Chick-fil-A Drive-thru Queue Study



Map 2: Proposed Drive-thru Queueing Distance

Chick-fil-A Drive-thru Queue Study

Table 3: Measured vs Simulated Existing Queue Lengths				
Peak Hour	Existing Avg Drive-thru Queue, Measured	Existing Avg Drive-thru Queue, Simulated	Existing Max Drive-thru Queue, Measured	Existing Max Drive-thru Queue, Simulated
AM	6*	12*	13*	14*
Mid-Day	31	37	41	45
PM	28	36	38	43

*Due to low volumes there is often a gap between the cars at the order window and cars at The pick-up window. The queue reported assumes this gap is filled to accurately represent Furthest back the queue reaches.

Table 4 below provides a comparison of the queue lengths of the simulation of existing conditions and the simulation with proposed conditions.

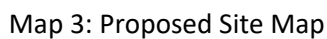
Table 4: Existing Simulated vs Proposed Simulated Queue Lengths		
Peak Hour	Existing Max Drive-thru Queue	Proposed Max Drive-thru Queue
AM	13*	15*
Mid-Day	45	32
PM	43	33

*Due to low volumes there is often a gap between the cars at the order window and cars at The pick-up window. The queue reported assumes this gap is filled to accurately represent Furthest back the queue reaches.

Based on the results of the simulations it is anticipated that the maximum queue will be reduced by approximately 10 vehicles (5 each lane) during the mid-day and PM peak hours, the higher volume peaks. The microsimulation model developed using engineering judgement and the data collected in the field demonstrates that vehicles will be able to queue on-site. The model also shows an additional 6 cars (3 each lane) worth of queue that is not used in the simulation. This provides an additional buffer for the results.

Images of the microsimulations can be found in the Appendix of this report. These images are snapshots of the site throughout the peak hours. The images are not intended to represent the data in the table.

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Appendix

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400 Shoppers Drive
Winchester, KY, 40391

Orland Park, IL Chick-fil-A
Drive Thru Study
Traffic Entering Drive Thru

File Name : Drive Thru Traffic Values
Site Code : 00000000
Start Date : 9/24/2020
Page No : 1

Groups Printed- Cars

Start Time	Entering Drive Thru From South		App. Total	Int. Total
	Thru			
08:00 AM	13		13	13
08:15 AM	7		7	7
08:30 AM	11		11	11
08:45 AM	12		12	12
Total	43		43	43
09:00 AM	6		6	6
09:15 AM	13		13	13
09:30 AM	13		13	13
09:45 AM	20		20	20
Total	52		52	52
*** BREAK ***				
11:00 AM	29		29	29
11:15 AM	31		31	31
11:30 AM	36		36	36
11:45 AM	30		30	30
Total	126		126	126
12:00 PM	34		34	34
12:15 PM	48		48	48
12:30 PM	49		49	49
12:45 PM	38		38	38
Total	169		169	169
*** BREAK ***				
04:00 PM	27		27	27
04:15 PM	26		26	26
04:30 PM	32		32	32
04:45 PM	40		40	40
Total	125		125	125
05:00 PM	39		39	39
05:15 PM	49		49	49
05:30 PM	38		38	38
05:45 PM	48		48	48
Total	174		174	174
06:00 PM	37		37	37
06:15 PM	39		39	39
06:30 PM	41		41	41
06:45 PM	40		40	40
Total	157		157	157
Grand Total	846		846	846
Apprch %	100			
Total %	100		100	

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400 Shoppers Drive
Winchester, KY, 40391

File Name : Drive Thru Traffic Values

Site Code : 00000000

Start Date : 9/24/2020

Page No : 2

	Entering Drive Thru From South		
Start Time	Thru	App. Total	Int. Total
Peak Hour Analysis From 08:00 AM to 08:45 AM - Peak 1 of 1			
Peak Hour for Entire Intersection Begins at 08:00 AM			
08:00 AM	13	13	13
08:15 AM	7	7	7
08:30 AM	11	11	11
08:45 AM	12	12	12
Total Volume	43	43	43
% App. Total	100		
PHF	.827	.827	.827

Peak Hour Analysis From 09:00 AM to 12:45 PM - Peak 1 of 1

Peak Hour for Entire Intersection Begins at 12:00 PM

12:00 PM	34	34	34
12:15 PM	48	48	48
12:30 PM	49	49	49
12:45 PM	38	38	38
Total Volume	169	169	169
% App. Total	100		
PHF	.862	.862	.862

Peak Hour Analysis From 01:00 PM to 05:45 PM - Peak 1 of 1

Peak Hour for Entire Intersection Begins at 05:00 PM

05:00 PM	39	39	39
05:15 PM	49	49	49
05:30 PM	38	38	38
05:45 PM	48	48	48
Total Volume	174	174	174
% App. Total	100		
PHF	.888	.888	.888

AM SIMULATION IMAGES

Existing Conditions:



Proposed Conditions:



*Images were taken at the same time in both models

AM SIMULATION IMAGES

Existing Conditions:



Proposed Conditions:



*Images were taken at the same time in both models

MID-DAY SIMULATION IMAGES

Existing Conditions:



Proposed Conditions:



*Images were taken at the same time in both models

MID-DAY SIMULATION IMAGES

Existing Conditions:



Proposed Conditions:



*Images were taken at the same time in both models

MID-DAY SIMULATION IMAGES

Existing Conditions:



Proposed Conditions:



*Images were taken at the same time in both models

PM SIMULATION IMAGES

Existing Conditions:



Proposed Conditions:



*Images were taken at the same time in both models

PM SIMULATION IMAGES

Existing Conditions:



Proposed Conditions:



*Images were taken at the same time in both models

PM SIMULATION IMAGES

Existing Conditions:



Proposed Conditions:



*Images were taken at the same time in both models



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