

Drive-Thru Queue Generation

1.0 Introduction

This report provides queuing data for businesses with drive-thru services. It is intended to be an aid for site designers and reviewers, similar to the Institute of Transportation Engineers' *Trip Generation* and *Parking Generation* reports. The data presentation is modeled on the Parking Generation report and data is provided based on at least four days of data for each land use type.

2.0 Data Collection

Data was collected using COUNTcam2 video recording systems at a total of 16 drive-thru locations in Minneapolis, MN and several surrounding suburbs between November 2018 and March 2019, which should represent peak usage in the cold Minnesota winter. Videos of drive-thru lanes were collected at banks, coffee shops, fast food restaurants, pharmacies, and thrift stores. Each location was recorded for between one and four days where most locations were recorded for two consecutive days. The days of the week that each video was recorded on varies.

The 24-hour videos were watched at high speeds with COUNTpro software and maximum queues throughout the day were noted. Most of the COUNTcam2s were set up such that the entire queue lane could be seen, but at a few locations the drive-thru lanes wrapped around the building in a way that the entire queue length would not be able to be seen. For these situations, the COUNTcam2s were set up so that the ordering window and back of the queue could be seen and it was noted how many vehicles could fit between the ordering window and the front of the queue. For drive-thru locations with multiple lanes, the number of lanes was noted but the maximum queue is defined as the sum of the queues at each lane for any given point in time, not the queue per lane. This approach provides overall demand, which may assist designers in determining how many drive-thru lanes are appropriate in addition to determining how long they should be.

3.0 Data Analysis

3.1 Banks

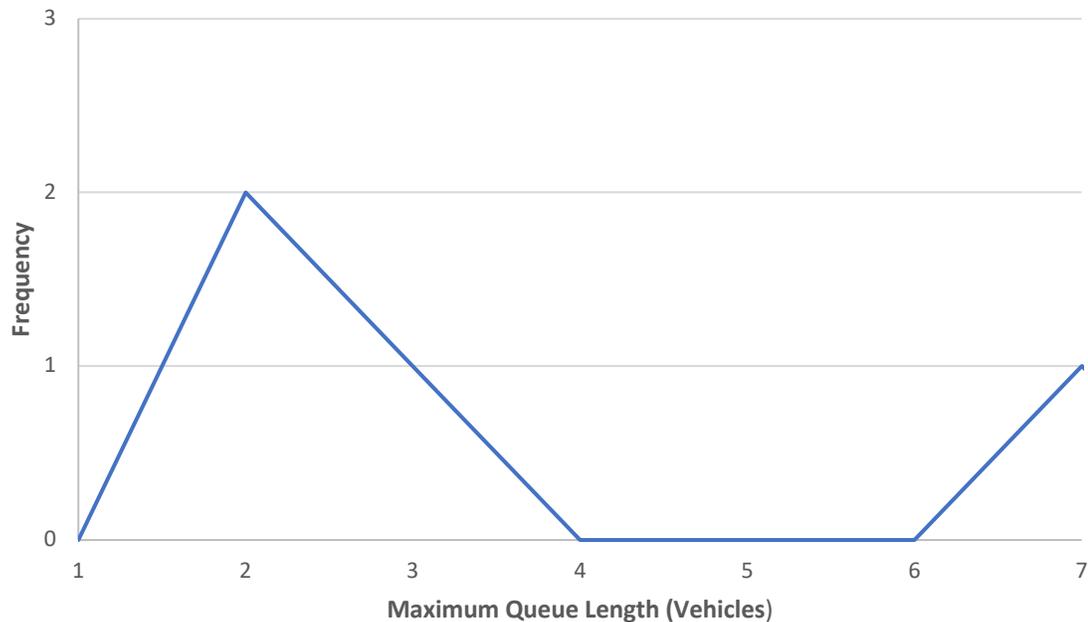
Data collection was done at two banks with drive-thru in February 2019. Four days of data were collected. The banks were located in the cities of Brooklyn Center and Edina, MN.

Both of the locations had a lane with a drive-thru ATM and at least two other lanes. Though service times may differ for ATM lanes compared to the regular lanes, the maximum queues were counted together. This is because based upon what was observed, vehicles would occasionally switch the lane they were in. For example, a vehicle waiting in the ATM line with a queue of three vehicles may move over to a regular line with a queue of only one vehicle. Much of what can be done at the bank’s drive-thru lane can also be accomplished at that bank’s ATM and vice versa.

Table 3.1 – Drive-Thru Bank Maximum Queue Statistics

Number of Data Points	4
Average Maximum Queue (Vehicles)	3.50
Standard Deviation (Vehicles)	2.38
Coefficient of Variation	68%
Range (Vehicles)	2 to 7
85th Percentile (Vehicles)	7.00
33rd Percentile (Vehicles)	2.00

Figure 3.1 – Drive-Thru Bank Maximum Queue Frequency



The number of available lanes at banks, not including the ATM lane, ranged from two to four lanes. Even though plenty of lanes were available, cars often stacked at the lane closest to the building, thus additional lanes may not result in shorter queues. With an 85th percentile maximum queue of seven vehicles, the data suggests that banks with drive-thru lanes should be able to accommodate 140 feet of vehicle stacking.

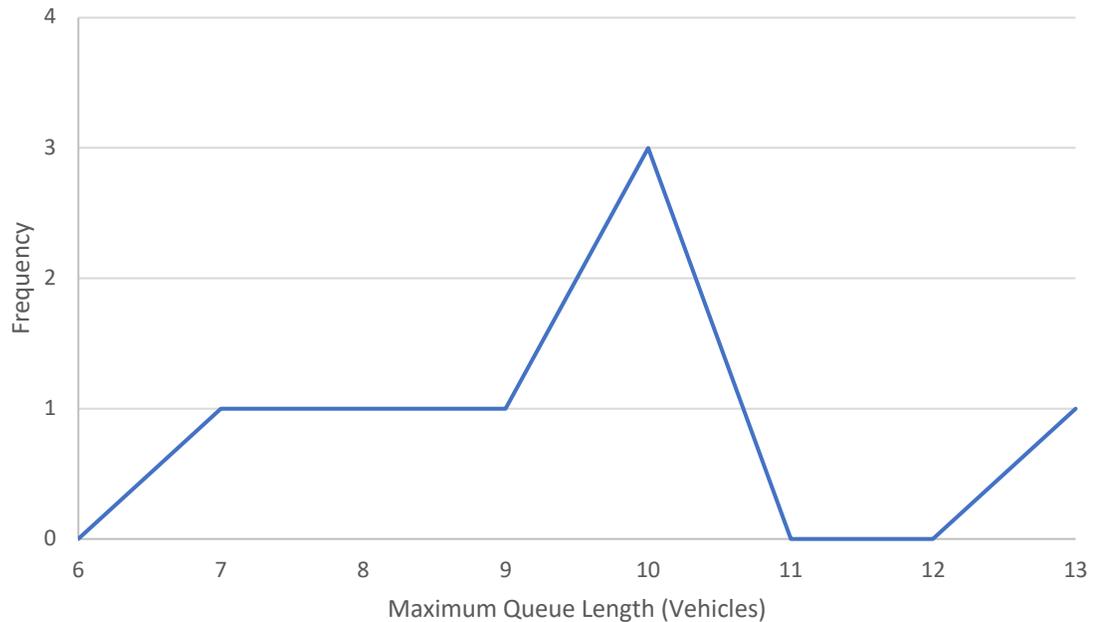
3.2 Coffee Shops

Data collection was done at four coffee shops with drive-thru services between November 2018 and March 2019. Seven days of data were collected. The coffee shops were located in the cities of Bloomington, Edina, Richfield, and West St. Paul, MN. Vehicles being served at the drive-thru window were counted as being in the queue.

Table 3.2 – Drive-Thru Coffee Shop Maximum Queue Statistics

Number of Data Points	7
Average Maximum Queue (Vehicles)	9.57
Standard Deviation (Vehicles)	1.90
Coefficient of Variation	20%
Range (Vehicles)	7 to 13
85th Percentile (Vehicles)	12.40
33rd Percentile (Vehicles)	8.64

Figure 3.2 – Drive-Thru Coffee Shop Maximum Queue Frequency



The maximum queues for coffee shops were concentrated between 7:00am and 10:00am. With an 85th percentile maximum queue of 12 vehicles, the data suggests that coffee shops with drive-thru lanes should be able to accommodate at least 240 feet of vehicle stacking during morning hours.

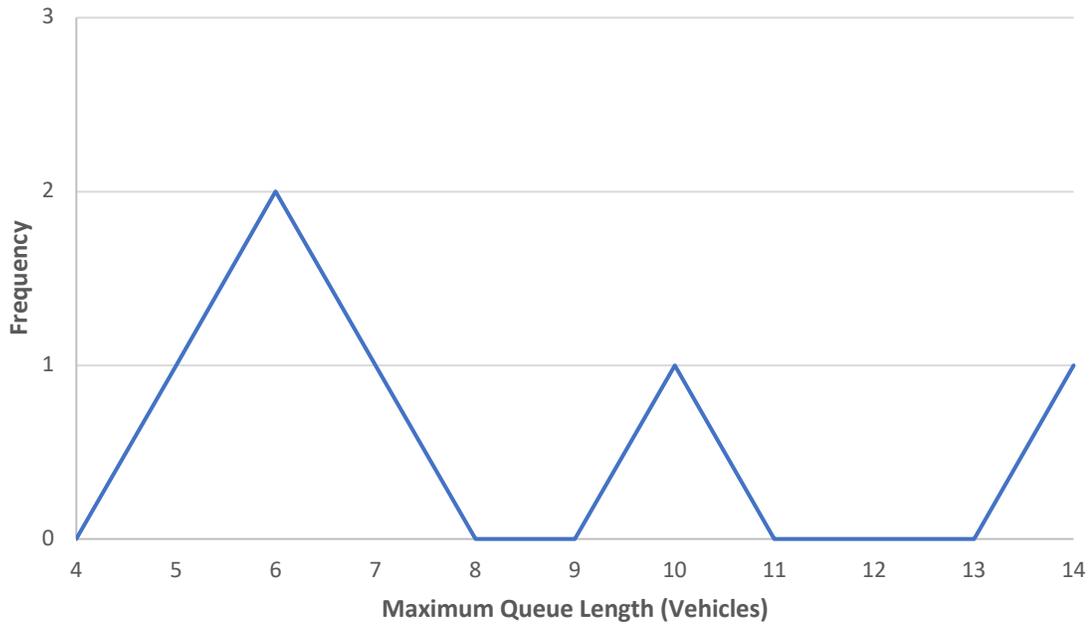
3.3 Fast Food Restaurants

Data collection was done at four fast food restaurants with drive-thru services in November 2018 and January 2019. Six days of data were collected. The restaurants were located in the cities of Bloomington and St. Paul, MN. Vehicles being served at the drive-thru window were counted as being in the queue.

Table 3.3 – Drive-Thru Fast Food Restaurant Maximum Queue Statistics

Number of Data Points	6
Average Maximum Queue (Vehicles)	8.00
Standard Deviation (Vehicles)	3.41
Coefficient of Variation	43%
Range (Vehicles)	5 to 14
85th Percentile (Vehicles)	13.80
33rd Percentile (Vehicles)	6.00

Figure 3.3 - Drive-Thru Fast Food Restaurant Maximum Queue Frequency



The maximum queues for fast food restaurants were spread throughout the afternoon from 12:00pm to 11:30pm. With an 85th percentile maximum queue of nearly 13 vehicles, the data suggests that fast food restaurants with drive-thru lanes should be able to accommodate 260 feet of vehicle stacking throughout the day.

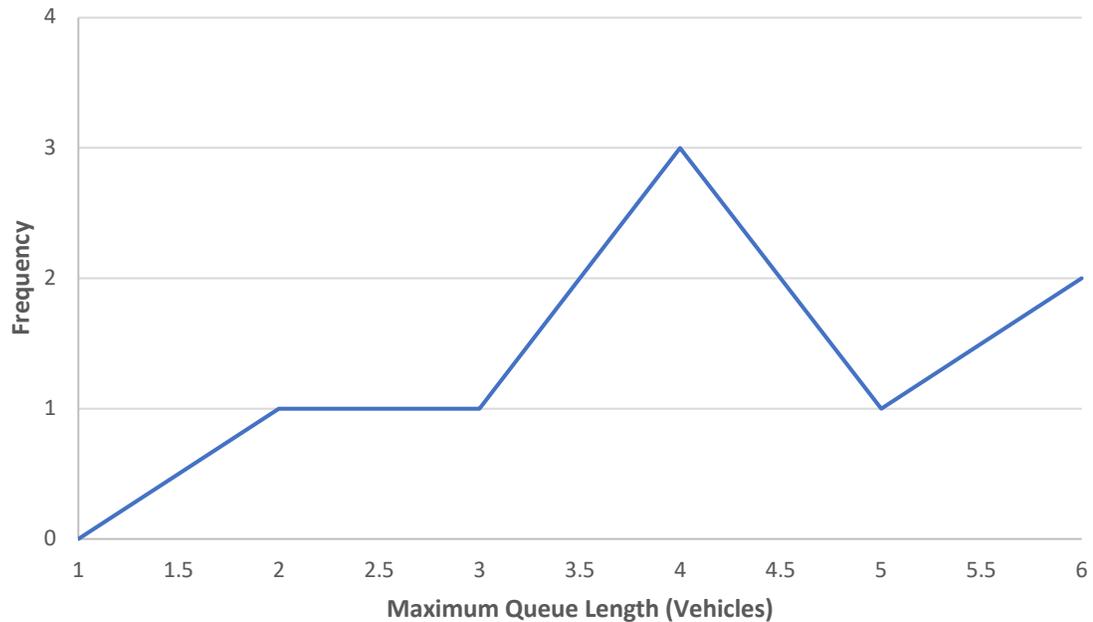
3.4 Pharmacies

Data collection was done at four pharmacies with drive-thru services in January and February 2019. Eight days of data were collected. The pharmacies were located in the cities of Bloomington, Mendota Heights, St. Paul, and West St. Paul, MN. Vehicles being served at the drive-thru window were counted as being in the queue.

Table 3.4 – Drive-Thru Pharmacy Maximum Queue Statistics

Number of Data Points	8
Average Maximum Queue (Vehicles)	4.25
Standard Deviation (Vehicles)	1.39
Coefficient of Variation	33%
Range (Vehicles)	3 to 6
85th Percentile (Vehicles)	6.00
33rd Percentile (Vehicles)	3.97

Figure 3.4 – Drive-Thru Pharmacy Maximum Queue Frequency



The maximum queues for pharmacies were spread throughout the day from 11:00am to 7:00pm. With an 85th percentile maximum queue of six vehicles, the data suggests that pharmacies with drive-thru lanes should be able to accommodate 120 feet of vehicle stacking throughout the day.

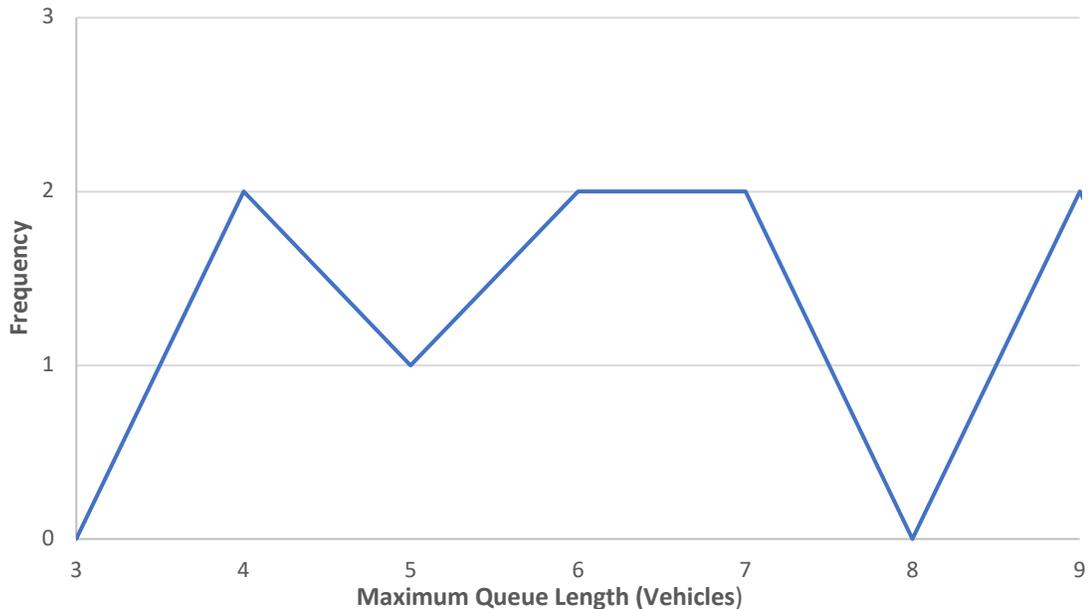
3.5 Thrift Stores

Data collection was done at two thrift stores with drive-thru donation services in March 2019. Eight days of data were collected, which included Saturdays and Sundays. The thrift stores were located in the cities of Roseville and Woodbury, MN. Vehicles being served in the donation garage were counted as being in the queue.

Table 3.5 – Drive-Thru Thrift Store Maximum Queue Statistics

Number of Data Points	8
Average Maximum Queue (Vehicles)	6.38
Standard Deviation (Vehicles)	2.00
Coefficient of Variation	31%
Range (Vehicles)	4 to 9
85th Percentile (Vehicles)	9.00
33rd Percentile (Vehicles)	4.97

Figure 3.4 – Drive-Thru Thrift Store Maximum Queue Frequency



The maximum queues for thrift store donations were spread throughout the day from 11:00am to 7:00pm. With an 85th percentile maximum queue of nine vehicles, the data suggests that thrift stores with drive-thru donation lanes should be able to accommodate 180 feet of vehicle stacking throughout the day. Data collected over the weekends typically showed a maximum queue of one vehicle greater than what occurred over the weekdays, however, the maximum queue did not increase by more than two vehicles between weekends and weekdays.

4.0 Conclusions

The observed 85th percentile maximum queue lengths for each land use are: 140 feet for banks (seven vehicles), 240 feet for coffee shops (12 vehicles), 260 feet for fast food restaurants (13 vehicles), 100 feet for pharmacies (six vehicles), and 180 feet for thrift stores (nine vehicles).

While some of the locations observed have an excess of space dedicated to drive-thru lanes (i.e. some banks and pharmacies), others could occasionally use additional space for drive-thru lanes (i.e. coffee shops in the morning).

Fast food restaurants and coffee shops have the longest maximum queues of the five land uses observed. Coffee shops were observed to have morning queues long enough spill out onto the street, though, as is expected, their afternoon and evening queues are minimal. Fast food restaurants also have large queues, but they tended to have enough dedicated space that stacking and rarely went beyond the designated queuing area.

The data collected for this paper in addition to the information presented in a 2012 study done by Spack Solutions will hopefully provide useful data for traffic engineers and others trying to analyze drive-thru queuing storage areas.

5.0 Drive-Thru Queue Generation – 2012 Study

6.0 Appendix – Detailed Count Results