Kimley»Horn

July 7, 2021

Ms. Patricia Hill C/O Mr. Robert Montgomery
Raising Cane's Restaurants, L.L.C
Property Development Manager
6800 Bishop Road
Plano, TX 75024

Re: Raising Canes – Port St. Lucie
Queue Analysis
Port St. Lucie, Florida

Dear Ms. Hill:

Kimley-Horn and Associates, Inc. has prepared a queuing analysis for the proposed Raising Canes located on the northwest corner of St. Lucie W Boulevard & NW Central Park Plaza in Port St. Lucie, Florida. The proposed restaurant is planned to be 3,181 SF in size and include a dual-lane drive-through.

DRIVE-THROUGH CONFIGURATION

As previously stated, the proposed development plan includes the implementation of a dual-lane drive-through. The proposed drive-through configuration allows drive-through access from two separated lanes, each with its own order board.

Patrons are expected to be distributed evenly between the two drive-through lanes. During peak periods, two operators inside the restaurant take orders to expedite the process. After placing an order, vehicles then continue in both lanes before the receiving their order at the end of the drive through. Since multiple orders can be placed at once or an order may be placed in one lane while motorists read the menu in the other lane, the efficiency of order taking is greater; therefore, more transactions can be handled at dual drive-through lanes than at single drive-through lanes.

This analysis was performed to determine the adequacy of queue storage at both the order boards and at the final order pickup. The results of the analysis are summarized below.

POISSON QUEUING ANALYSIS AT DRIVE-THROUGH

A drive-through queuing analysis was performed in accordance with the methodologies provided within *Transportation and Land Development, 1st Edition*.

A Poisson Queuing analysis was performed for this site to determine if sufficient storage is provided within the fast food drive-through lanes before the order boards and before the order pickup. As indicated in the site plan, a total of five queuing spaces are proposed in each lane before the order boards and a total of six queuing spaces are proposed in each lane after the order boards and before the order pickup.

It was assumed that approximately 75% of the inbound traffic will use the drive-through and that the remaining 25% will park and enter the restaurant. It is also assumed that approximately 50% of the drive-through patrons will use each of the drive-through lanes It is also assumed that on average it will take a total of approximately 75 seconds to process the queued vehicles (15 seconds at the order board and 60 seconds at the order pickup). This gives a wait time to process the vehicles equal to Δ = 15 seconds at the order boards and Δ = 60 seconds at the order pickup.

Dual Lanes Prior to Order Boards

This analysis demonstrated that the queues before each order board would be accommodated in the proposed storage lanes over 99 percent of the time. This methodology determines the probability that adequate storage is provided given an arrival rate:

$$P(n) = \frac{(\lambda\Delta)^n e^{-\lambda\Delta}}{n!}$$

Where:

Δ = analysis period or average wait time to order;
λ = expect inbound arrival rate of vehicles; and
n = average number of vehicles arriving during the analysis period.

Based on the trip generation rates and equations published by the Institute of Transportation Engineers (ITE) in the *Trip Generation Manual, 10th Edition*, the expected maximum arrival rate is 65 inbound vehicles in the AM peak hour, or 49 inbound vehicles in the drive-through lanes (75% of 65 total inbound vehicles), or 25 vehicles in each drive-through lane (50% of 49 inbound vehicles) which is equal to λ = 0.0136 vehicles per second (i.e. 49 vehicles per hour divided by 3,600 seconds per hour). The trip generation calculations are included in *Table 1*.

The average number of vehicles arriving at each order board during the analysis period is equal to: $n = \lambda * \Delta$ = 0.816 vehicles.

Based on the proposed site plan, the length of the queuing line in the drive-through area can accommodate a total of five vehicles before the order boards. If the storage capacity is equal to *N*, then *N* should be large enough such that $P(n \le N)$ is equal or greater than the desired level of confidence of 0.95. To verify if the probability $P(n \le N)$ is equal or greater than the desired level of confidence, the following applies:

$$P(n \le 5) = e^{-\lambda\Delta}(\lambda\Delta)^n/n! = (.816^5) * e^{-.816}/5! = 0.00133$$

Therefore, it is not expected that the drive-through will have a queue longer than five vehicles in each lane prior to the order board over 99 percent of the time. Thus, providing five or more queuing spaces in each lane from the order board will be sufficient to serve the queues at each order board and impose minimum adverse impact on the onsite or adjacent street traffic operation.

Dual Lanes Prior to Order Pickup

This analysis demonstrated that the queue at the order pickup would be accommodated in the proposed storage lane over 99 percent of the time. This methodology determines the probability that adequate storage is provided given an arrival rate:

$$P(n) = \frac{(\lambda\Delta)^n e^{-\lambda\Delta}}{n!}$$

Where:

Δ = analysis period or average wait time to receive order;
λ = expect inbound arrival rate of vehicles; and
n = average number of vehicles arriving during the analysis period.

Based on the trip generation rates and equations published by the Institute of Transportation Engineers (ITE) in the *Trip Generation Manual, 10th Edition*, the expected maximum arrival rate is 65 inbound vehicles in the AM peak hour, or 49 inbound vehicles in the drive-through lanes (75% of 65 total inbound vehicles), or 25 vehicles in each drive-through lane (50% of 49 inbound vehicles) which is equal to λ = 0.0136 vehicles per second (i.e. 49 vehicles per hour divided by 3,600 seconds per hour). The trip generation calculations are included in *Table 1*.

The average number of vehicles arriving at each order board during the analysis period is equal to: $n = \lambda * \Delta$ = 0.816 vehicles.

Based on the proposed site plan, the length of the queuing line in the drive-through area can accommodate a total of five vehicles before the order pickup. If the storage capacity is equal to *N*, then *N* should be large enough such that $P(n \le N)$ is equal or greater than the desired level of confidence of 0.95. To verify if the probability $P(n \le N)$ is equal or greater than the desired level of confidence, the following applies:

$$P(n \le 5) = e^{-\lambda\Delta}(\lambda\Delta)^n/n! = (.816^6) * e^{-.816}/6! = 0.000181$$

Therefore, it is not expected that the drive-through will have a queue longer than six vehicles in each of the dual lanes prior to the order pickup more than 99 percent of the time. Thus, providing six queuing spaces in each of the dual lanes will be adequate enough to serve the queue before the order pickup and impose minimum adverse impact on the onsite or adjacent street traffic operation.

CONCLUSION

The foregoing analysis demonstrates that the drive-through lanes will not have a queue longer than five vehicles at each order board more than 99 percent of the time or a queue longer than six vehicles in each lane at the order pickup more than 99 percent of the time. Thus, providing at least five vehicles of queuing space in each lane prior to the order board and six vehicles of queuing space in each lane prior to the order pickup will be adequate to serve the site without impacting efficient site circulation.

Please contact me at (561) 840-0852 or Stephanie.Kinlen@kimley-horn.com should you have any questions.

Sincerely,
KIMLEY-HORN AND ASSOCIATES, INC.

Stephanie A Kinlen
2021.07.07
08:54:13 -04'00'

Stephanie A. Kinlen P.E.
Transportation Engineer

Florida Registration
Number 64773
Certificate of Authorization
Number 696

Attachments

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Table 1: Trip Generation Calculations

Driveway Volumes		Daily Trips	AM Peak Hour			PM Peak Hour		
			Total	In	Out	Total	In	Out
Fast Food Restaurant + DT	3.181 KSF	1498	128	65	63	104	54	50