

To: Eric Bikas, QuikTrip Corporation

From: Jin Seo, P.E., KDS Development and Engineering

Date: July 6, 2026

Subject: ***Traffic Memorandum***
Bubble Bath Car Wash 61816 – Queuing Analysis
Snellville, Georgia

1.0 Introduction and Background

This memorandum documents the results of the projected trips and estimated queues for the proposed Bubble Bath Car Wash 61816. The site is located on the southeast quadrant of the intersection of US 78 / Athens Highway at Rockdale Circle, Snellville, Georgia, next to an existing QuikTrip gas station. A site location map and site aerial are provided in the Attachments.

As currently envisioned, the proposed site will consist of 1 automated car wash tunnel with 2 lanes for pay stations leading into the car wash tunnel. The site will share the existing driveway along US 78 / Athens Highway and inter-parcel access will be provided between the proposed Bubble Bath Car Wash 61816 and the QuikTrip gas station.

2.0 Trip Generation

Gross trips associated with the proposed development were estimated using the *Institute of Transportation Engineers (ITE) Trip Generation Manual, 11th edition, 2021*, using equations where available. Trip generation for this proposed development was calculated based upon the following land uses:

- Land Use 948: Automated Car Wash

It should be noted that for the Automated Car Wash (LU 948), ITE Trip Generation Manual does not provide weekday daily and AM peak hour rates. **Table 1** below summarizes the projected PM peak hour trip generation for the proposed development.

Table 1: Trip Generation					
Land Use Code	Land Use	Density	PM Peak Hour		
			Total	Enter	Exit
948	Automated Carwash	1 Tunnel	78	39	39
Gross Project Trips			78	39	39

As shown on **Table 1**, the car wash is projected to generate 78 vehicles per hour during the peak hour.

3.0 Queuing Analysis

3.1 Proposed Stacking Storage Provided

As currently envisioned and as shown on the site plan, approximately 7 vehicles are able to stack between the car wash tunnel and the pay stations, and approximately 9 vehicles are able to stack between the pay stations and the internal driveway connection to existing QuikTrip gas station.

The site plan is provided in the Attachments.

3.2 Car Processing Times

Based on discussions with car wash representatives, the car wash can service vehicles at the following rates:

- Car wash tunnel: 120 vehicles per hour
- Pay Station (Manual): 45 seconds per transaction per lane (2 total)

The above service rates were utilized for the queueing analysis.

3.3 Queueing Analysis: Car Wash Tunnel

A queueing analysis for the car tunnel was performed in accordance with the M/M/1 queue methodology, which utilizes the arrival rates determined by the Poisson process. The following assumptions were made for the queueing analysis:

- The average arrival rate (λ) during the peak hour is 78 vehicles per hour per ITE's *Trip Generation Manual*.
- All cars are serviced by a single tunnel.
- The average service rate (μ) for a car wash tunnel is 120 vehicles per hour.

The following equation is used to determine the queue length at the drive-through lane:

$$\rho = \frac{\lambda}{\mu}$$

For $n = 0$ (Probability of 0 vehicles in queue)

$$P_0 = 1 - \rho = 1 - \frac{\lambda}{\mu}$$

For $n \geq 1$ (Probability of n vehicles in queue)

$$P_n (\text{for } n \geq 1) = P_0 \cdot \rho^n$$

Where:

- λ = arrival rate
- μ = service rate
- ρ = utilization

The results of the car wash tunnel queueing analysis are shown in **Table 2**.

Table 2: Queue Length Probabilities – Car Wash Tunnel		
$\lambda = 78$ vph, $\mu = 120$ vph		
# vehicles in queue (n)	Probability of n vehicles in queue (P_n)	Cumulative Probability
0	35.00%	35.00%
1	22.75%	57.75%
2	14.79%	72.54%
3	9.61%	82.15%
4	6.25%	88.40%
5	4.06%	92.46%
6	2.64%	95.10%
7	1.72%	96.81%
8	1.12%	97.93%
9	0.72%	98.65%
10	0.47%	99.12%
11	0.31%	99.43%
12	0.20%	99.63%
13	0.13%	99.76%
14	0.08%	99.84%
15	0.05%	99.90%
16	0.04%	99.93%
17	0.02%	99.96%
18	0.02%	99.97%
19	0.01%	99.98%
20	0.01%	99.99%
21	0.00%	99.99%
22	0.00%	100.00%
23	0.00%	100.00%
24	0.00%	100.00%
25	0.00%	100.00%

Based on the results shown in **Table 2**, the 95th percentile queue at the car wash tunnel is estimated to be approximately six (6) vehicles. Therefore, the **provided stacking storage (7 vehicles) between the car wash tunnel entrance and pay station is sufficient to contain the queued vehicles (6 vehicles).**

3.4 Queueing Analysis: Pay Stations

A queueing analysis for the car tunnel was performed in accordance with the M/M/2 queue methodology, which utilizes the arrival rates determined by the Poisson process. The following assumptions were made for the queueing analysis:

- The average arrival rate (λ) during the peak hour is 78 vehicles per hour per ITE's *Trip Generation Manual*.
- The average service rate (μ) for manual pay stations is 80 vehicles per hour per lane.
- All vehicles utilize manual pay stations.

The following equation is used to determine the queue length at the drive-through lane:

$$\rho = \frac{\lambda}{2\mu}$$

For $n = 0$ (Probability of 0 vehicles in queue)

$$P_0 = \frac{1 - \rho}{1 + \rho}$$

For $n = 1$ (Probability of 1 vehicle in queue)

$$P_n = \left(\frac{\lambda}{\mu}\right) \cdot P_0$$

For $n > 3$ (Probability of n vehicles in queue)

$$P_n \text{ (for } n > 2) = \frac{(\lambda/\mu)^n}{2! 2^{n-2}} P_0$$

Where:

λ = arrival rate
 μ = service rate
 ρ = utilization

The results of the pay station queueing analysis are shown in **Table 3**.

Table 3: Queue Length Probabilities – Pay Stations		
$\lambda = 78 \text{ vph}, \mu = 80 \text{ vph}$		
# vehicles in queue (n)	Probability of n vehicles in queue (P_n)	Cumulative Probability
0	34.45%	34.45%
1	33.59%	68.05%
2	16.38%	84.42%
3	7.98%	92.41%
4	3.89%	96.30%
5	1.90%	98.20%
6	0.92%	99.12%
7	0.45%	99.57%
8	0.22%	99.79%
9	0.11%	99.90%
10	0.05%	99.95%
11	0.03%	99.98%
12	0.01%	99.99%
13	0.01%	99.99%
14	0.00%	100.00%
15	0.00%	100.00%
16	0.00%	100.00%
17	0.00%	100.00%
18	0.00%	100.00%
19	0.00%	100.00%
20	0.00%	100.00%
21	0.00%	100.00%
22	0.00%	100.00%
23	0.00%	100.00%
24	0.00%	100.00%
25	0.00%	100.00%

Based on the results shown in **Table 3**, the 95th percentile queue at the pay stations is estimated to be approximately four (4) vehicles. Therefore, **the provided stacking storage (9vehicles) between the car wash tunnel entrance and pay station is sufficient to contain the queued vehicles (4 vehicles).**

4.0 Conclusion

The proposed car wash is located on the southeast quadrant of the intersection of US 78 / Athens Highway at Rockdale Circle, Snellville, Georgia, next to an existing QuikTrip gas station. As currently envisioned, the proposed site will consist of 1 automated car wash tunnel with 2 lanes for pay stations leading into the car wash tunnel.

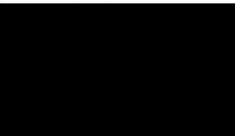
Additionally, queuing analysis was performed for the proposed car wash to determine if proposed storage for the car wash is sufficient based on the projected queue. **Table 4** below summarizes the proposed stacking storage and the projected queues.

Table 4: Summary of Provided Storage vs Projected Queues # of vehicles			
Location	Provided Storage	Projected 95 th Percentile Queue	Sufficient Storage?
Between Car Wash Tunnel and Pay Stations	7 vehicles	6 vehicles	✓
Between Pay Stations and Internal QT Driveway	9 vehicles	4 vehicles	✓

Based on the results of the queueing analysis, the proposed site plan and the proposed stacking storage provided between the car wash tunnel, pay stations, and the internal driveway connection to the QuikTrip gas station is projected to be **sufficient and able to accommodate the projected queueing for the Bubble Bath Car Wash 61816.**

We appreciate the opportunity to provide these services to you. If you have any questions, please contact me at [REDACTED] or email me at [REDACTED]

Sincerely,



Jin Seo, P.E.
Principal

Attachments

- Figure 1: Site Location Map
- Figure 2: Site Aerial