EXHIBIT PC-2: APPLICANT TRANSPORTATION IMPACT ANALYSIS LETTER

ARD ENGINEERING
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February 12, 2026

REGISTERED PROFESSIONAL ENGINEER 54983PE
JULY 10, 2002 MICHAEL T. ARD
RENEWS: 12/31/2027

Chris Myers, Associate Planner
City of West Linn
22500 Salamo Road
West Linn, OR 97068

RE: 18850 Willamette Drive Car Wash: Transportation Impact Analysis Letter

Dear Mr. Myers,

This letter is written to provide information related to the transportation impacts of a proposed car wash facility at 18850 Willamette Drive in West Linn, Oregon. The purpose of this analysis is to provide information about the proposed use, make comparisons to the prior use of the site, examine expected queue lengths within the site, and provide information related to compatibility of the proposed conditional use with the surrounding environment.

Project and Location Description

The subject property is a 1.29-acre site that was previously home to a 3,948 square foot fast food restaurant with a drive-through window. However, the restaurant is no longer operational and the site has been unoccupied for several years. The property takes access via two driveways with one on Willamette Drive (OR Highway 43) and the other on Walling Way. These access driveways serve the Cedar Oaks Shopping Center, which includes the Backyard Burger Company, Kartcade, Smile Linn Dental clinic, Melani Studios Tattooing, Body&Brain Yoga/Tai Chi studio, and Umai Teriyaki restaurant.

Under the current proposal, the building that housed the prior restaurant will be removed, and an automated car wash facility will be constructed on the site. The car wash building will have a gross floor area of 3,190 square feet and will be centered within the site. A parking area will be provided on the north side of the building, with two staff parking spaces, 14 vacuum parking stalls, and one ADA vacuum parking stall. The ticketing and entry queue area will be at the south side of the site. Drivers will typically enter via the driveway on Willamette Drive and immediately turn right to enter the car wash queue. The entry splits into two lanes, each of which feeds into a ticket attendant station. The site layout provides a total of 300 feet of storage space for queueing vehicles between the ticket attendant stations and the site access, which is sufficient space for approximately 13 vehicles without queues extending into the site access driveway on Willamette Drive. Six additional vehicles can queue in the 140 feet between the ticketing stations and the car wash entrance, providing a total queue storage of 19 vehicles entering the car wash tunnel.

A site access and circulation diagram depicting the locations of the site access driveways, the proposed car wash tunnel, the parking area, and the queueing area is provided in Figure 1 below.

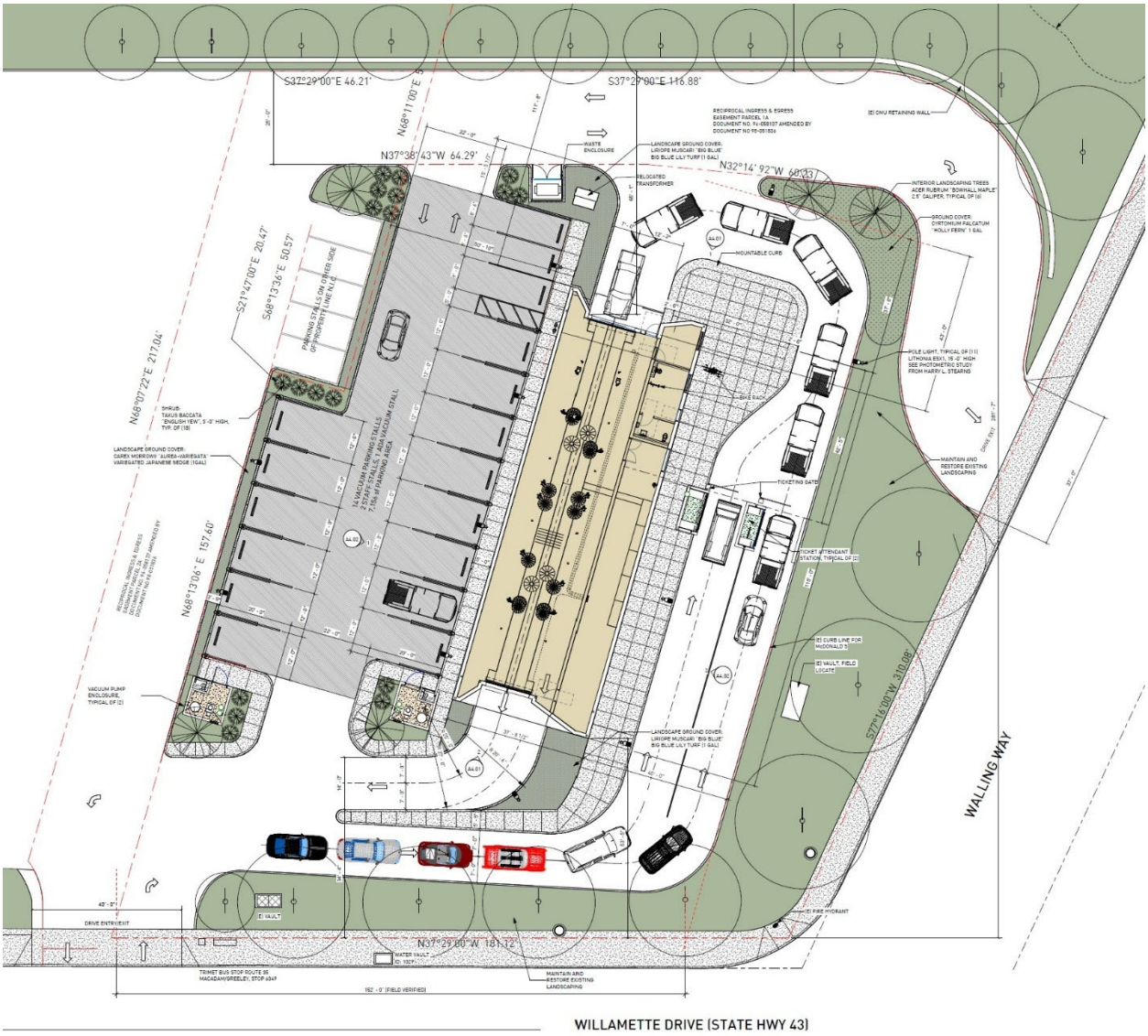

Figure 1: Site Access and Circulation Diagram

Willamette Drive (Oregon Hwy. 43) is classified by the City of West Linn as a Major Arterial roadway. It is also classified by the Oregon Department of Transportation as a Statewide Highway. It has one through lane in each direction in the immediate site vicinity, with turn lanes added at intersections. It has a posted speed limit of 35 mph. Sidewalks and bike lanes are in place on both sides of the roadway.

Walling Way is classified by the City of West Linn as a Local Street. It has a two-lane cross-section with one through lane in each direction and a posted speed limit of 25 mph. Existing sidewalks are in place on both sides of the roadway.

Trip Generation

To estimate the number of trips generated by the proposed use, data from the *ITE Trip Generation Manual, 11th Edition*, published by the Institute of Transportation Engineers was used. The data referenced was for land use code 948, Automated Car Wash. The ITE manual contains trip projections based on either the gross floor area of the facility and the number of car wash tunnels. A comparison of the two metrics revealed that using the number of car wash tunnels (i.e., one) results in a higher trip projection for the weekday evening peak hour, while using the gross floor area (i.e., 3,190 square feet) results in a higher trip projection for the Saturday peak hour. To maintain a conservative analysis, the higher trip generation estimates were used for both analysis periods.

Based on the calculations, the proposed car wash would be projected to generate 78 trips during the weekday evening peak hour and 96 trips during the Saturday peak hour. A summary of the trip generation calculations is provided in Table 1 below. Detailed trip generation calculation worksheets are also included in the attached technical appendix.

Table 1 - Trip Generation: Automated Car Wash

	PM Peak Hour			Saturday Peak Hour		
	In	Out	Total	In	Out	Total
3,190 sf or 1 tunnel	39	39	78	48	48	96

Since the proposed conditional may result in a change in operation as compared to the uses that are outright permitted within the site, one purpose of the trip generation estimate is to quantify how the trip generation characteristics of the site will change if the site is used for an automated car wash rather than other uses that are permitted outright within the underlying zone.

Uses permitted outright in the General Commercial (GC) zone include restaurants, general retail services, medical and dental offices, convenience stores, indoor recreation facilities, and community centers. Of the permitted uses, the highest traffic volumes would be generated by a convenience store or a fast-food restaurant with a drive-through window.

Re-occupancy of the existing 3,948 square-foot fast-food restaurant with a drive-through window would be projected to generate 130 trips during the weekday evening peak hour, and 218 Saturday peak hour trips. The comparison to this outright permitted land use shows that the proposed car wash would generate 47

percent fewer site trips during the evening peak hour and 60 percent fewer Saturday peak hour trips than a fast-food restaurant on the site (which also uses a drive-through window).

Alternatively, redevelopment of the site with a 3,000 square foot convenience store would be projected to generate 147 trips during the weekday evening peak hour, and 238 Saturday peak hour trips. The proposed car wash facility would generate 47 percent fewer weekday evening peak hour trips and 60 percent fewer Saturday peak hour trips than a 3,000 square foot convenience store within the site.

Based on the above comparisons, the proposed car wash facility is projected to have transportation impacts well below the levels associated with other outright permitted uses in the General Commercial zone. Notably, since the existing fast food restaurant with drive-through window on the site could be re-occupied, approval of the proposed car wash facility also represents a decrease in trip generation as compared to a use that is permitted without going through a land use approval process.

Queuing Analysis

Since the proposed car wash use requires on-site queuing, it is also appropriate to evaluate whether there is sufficient space to accommodate lines of vehicles waiting to enter the car wash tunnel. The potential site queues were analyzed using a review of prior studies of car wash facilities, direct observation of comparable Kaady Car Wash sites in the Portland Metro area, and using a mathematical model based on peak-hour service demands in conjunction with actual service times, assuming arrival of individual vehicles occurs at random times within the peak hour.

A search for prior studies yielded a 2012 study of various drive-through queues for facilities including banks, car washes, coffee shops, fast food restaurants, and pharmacies prepared by Mike Spack, PE in Minnesota. That study collected data for 6 car wash facilities, with a total of 12 days of observations. The study reported the maximum queues observed over the course of each examined day. The average maximum queue length was 4.42 vehicles, with a standard deviation of 2.31 vehicles. From the study, a high estimate of the maximum queue (85^{th} percentile) was 6.2 vehicles. The longest queue ever observed during the study was 10 vehicles. Notably, these observed car wash queue lengths were less than those reported for fast food restaurants. Fast food restaurants experienced average maximum queues of 8.5 vehicles, an 85^{th} percentile of 12 vehicles, and a maximum observed queue of 13 vehicles.

For local data, cameras were installed to observe one mid-week day and one weekend day at two Kaady Car Wash sites in the Portland metro area. The selected sites were at 9614 SW Tualatin Sherwood Road in Tualatin, Oregon and at 1909 W Burnside Street in Portland, Oregon. However, since there was rain during part of the weekend observations at the Tualatin Sherwood Road site, a second weekend of data was collected at that location. The maximum queue observed during a midweek day was 4 vehicles at the location in Tualatin (the maximum mid-week queue at the Burnside site was 2 vehicles). During weekend

operation, the maximum observed queue was also 4 vehicles at the location in Tualatin (the maximum weekend queue at the Burnside location was 3 vehicles).

The mathematical queuing model used was a Poisson distribution queuing model that used designated hourly arrival rates and service times to calculate the projected queue length. In order to provide for a very conservative analysis, the arrival rate used for the calculations was based on the highest trip generation data point contained in the ITE Trip Generation manual rather than the average trip generation rate. This trip rate was 37.75 trips per thousand square feet during the Saturday peak hour, which equates to 120 trips for the 3,190 square foot car wash, with half entering and half exiting the site (i.e., 60 vehicles arriving and 60 vehicles departing during the peak hour.) Additionally, the service rate was conservatively assumed to be 40 seconds per vehicle. Actual observation of car wash operations at the two Kaady Car Wash sites showed service times of as little as 30 seconds between vehicles when queues were present. Based on the calculations, the projected 95th percentile queue length for the very high estimated arrival rate was 7.4 vehicles.

Overall, the calculated queue length for the proposed car wash was 7.4 vehicles, and the maximum queue length observed at any car wash location among the data sets was 10 vehicles.

The proposed site plan provides sufficient space for 19 vehicles to queue prior to entering the wash tunnel.

Based on the analysis and the proposed site plan, the projected vehicle queues waiting to enter the car wash tunnel can safely be accommodated within the project site. Since the car wash queues are not projected to extend to the driveway, they will not impede the movement of vehicles entering and exiting the Cedar Oaks Shopping Center and are not projected to impact operation of either Willamette Drive or Walling Way.

CONCLUSIONS

Based on the transportation analysis, approval of the proposed automated car wash facility at 18850 Willamette Drive in West Linn, Oregon will not result in increases in traffic or degradation of operation of area roadways and intersections as compared to either the prior use of the site or other uses which are permitted outright in the General Commercial zone. Since the existing fast food restaurant with drive-through window on the site could be re-occupied, approval of the proposed car wash facility also represents a decrease in trip generation as compared to a use that is permitted without going through a land use approval process.

Based on the queuing analysis, the proposed site plan includes adequate space to accommodate the projected maximum queues without interfering with operation of the site access driveways or the adjacent public streets.

No additional travel demand, circulation, or queueing mitigation measures are recommended in conjunction with implementation of the proposed site plan for this conditional use.

If you have any questions regarding this analysis or if you need any further assistance, please don't hesitate to contact me.

Sincerely,

Michael Ard, PE
Principal Engineer

Appendix

Trip Generation Calculation Worksheet

Land Use Description: Automated Car Wash
ITE Land Use Code: 948
Independent Variable: Gross Floor Area
Quantity: 3.19 Thousand Square Feet

Summary of ITE Trip Generation Data

PM Peak Hour of Adjacent Street Traffic
Trip Rate: 14.20 trips per ksf
Directional Distribution: 50% Entering 50% Exiting

Saturday Peak Hour of Generator
Trip Rate: 30.40 trips per ksf
Directional Distribution: 50% Entering 50% Exiting

Site Trip Generation Calculations

3.19 ksf Automated Car Wash

	Entering	Exiting	Total
PM Peak Hour	23	23	46
Saturday Hour	48	48	96

Data Source: *Trip Generation Manual, 11th Edition* , Institute of Transportation Engineers, 2021

Trip Generation Calculation Worksheet

Land Use Description: Automated Car Wash
ITE Land Use Code: 948
Independent Variable: Car Wash Tunnels
Quantity: 1 Car Wash Tunnel

Summary of ITE Trip Generation Data

PM Peak Hour of Adjacent Street Traffic
Trip Rate: 77.50 trips per car wash tunnel
Directional Distribution: 50% Entering 50% Exiting

Saturday Peak Hour of Generator
Trip Rate: 41.00 trips per car wash tunnel
Directional Distribution: 50% Entering 50% Exiting

Site Trip Generation Calculations

1 Car Wash Tunnel

	Entering	Exiting	Total
PM Peak Hour	39	39	78
Saturday Hour	21	21	42

Data Source: *Trip Generation Manual, 11th Edition* , Institute of Transportation Engineers, 2021

Trip Generation Calculation Worksheet

Land Use Description: Fast-Food Restaurant with Drive-Through
ITE Land Use Code: 934
Independent Variable: Gross Floor Area
Quantity: 3.948 Thousand Square Feet

Summary of ITE Trip Generation Data

AM Peak Hour of Adjacent Street Traffic
Trip Rate: 44.61 trips per ksf
Directional Distribution: 51% Entering 49% Exiting

PM Peak Hour of Adjacent Street Traffic
Trip Rate: 33.03 trips per ksf
Directional Distribution: 52% Entering 48% Exiting

Total Weekday Traffic
Trip Rate: 467.48 trips per ksf
Directional Distribution: 50% Entering 50% Exiting

Saturday Peak Hour
Trip Rate: 55.25 trips per ksf
Directional Distribution: 51% Entering 50% Exiting

Site Trip Generation Calculations

3.9 ksf Fast-Food Restaurant w/ Drive Thru

	Entering	Exiting	Total
AM Peak Hour	90	86	176
PM Peak Hour	68	62	130
Weekday	923	923	1846
Saturday Peak	111	107	218

Data Source: *Trip Generation Manual, 11th Edition* , Institute of Transportation Engineers, 2021

Trip Generation Calculation Worksheet

Land Use Description: Convenience Store
ITE Land Use Code: 851
Independent Variable: Gross Floor Area
Quantity: 3.00 Thousand Square Feet

Summary of ITE Trip Generation Data

AM Peak Hour of Adjacent Street Traffic
Trip Rate: 62.54 trips per ksf
Directional Distribution: 50% Entering 50% Exiting

PM Peak Hour of Adjacent Street Traffic
Trip Rate: 49.11 trips per ksf
Directional Distribution: 51% Entering 49% Exiting

Total Weekday Traffic
Trip Rate: 762.28 trips per ksf
Directional Distribution: 50% Entering 50% Exiting

Saturday Peak Hour Traffic
Trip Rate: 79.12 trips per ksf
Directional Distribution: 50% Entering 50% Exiting

Site Trip Generation Calculations

3.00 ksf Convenience Store

	Entering	Exiting	Total
AM Peak Hour	94	94	188
PM Peak Hour	75	72	147
Weekday	1143	1143	2286
Saturday Peak	119	119	238

Data Source: *Trip Generation Manual, 11th Edition* , Institute of Transportation Engineers, 2021

The data for Kansas banks was collected between 4:30pm and 6:00pm. While many of the maximum queues for the data collected in Minnesota were between these times, maximum queues occurred between 8:30am and 5:30pm so it is possible that some of the Kansas data does not capture the actual maximum queues for the day.

The number of available lanes at banks, not including the ATM lane, ranged from two to seven lanes (though the most open at one time was five 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 eight vehicles, the data suggests that banks with drive-through lanes should be able to accommodate 160 feet of vehicle stacking.

3.2 Car Washes

Data collection was done at six car washes with drive-through services (including one full-service car wash) in February 2012. Twelve days of data were collected. The car washes were located in the cities of Falcon Heights, Hopkins, Minneapolis, Roseville and St. Louis Park, MN. Five of the six car washes (excluding the full-service car wash) were located at gas stations. Only the vehicles waiting in line were counted; vehicles being washed were not added to the queue.

Table 3.2 – Drive-Through Car Wash Maximum Queue Statistics

Number of Data Points	**12**
Average Maximum Queue (Vehicles)	**4.42**
Standard Deviation (Vehicles)	**2.31**
Coefficient of Variation	**52%**
Range (Vehicles)	**1 to 10**
85th Percentile (Vehicles)	**6.20**
33rd Percentile (Vehicles)	**3.00**

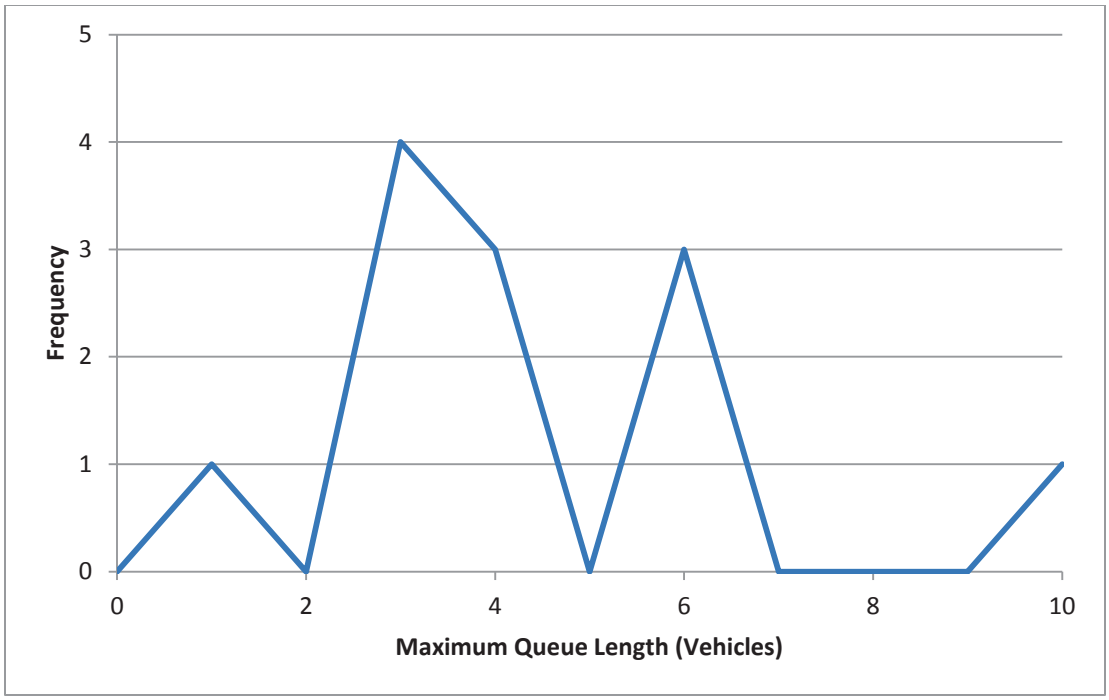

Figure 3.2 – Drive-Through Car Wash Maximum Queue Frequency

Two of the car washes had two lanes while the other four were one lane car washes. The full-service car wash had two lanes and also produced the highest maximum queue of 10 vehicles. The maximum queues for car washes were spread throughout the afternoon from 12:30pm to 8:30pm. With an 85th percentile maximum queue of more than six vehicles, the data suggests that car washes with drive-through lanes should be able to accommodate 140 feet of vehicle stacking throughout the day.

3.3 Coffee Shops

Data collection was done at six coffee shops with drive-through services in November 2010, August 2011 and February 2012. Fourteen days of data were collected. The coffee shops were located in the cities of Edina, Hopkins, Minneapolis, Roseville and St. Louis Park, MN. Vehicles being served were counted as being in the queue. Twelve days of data from the Kansas City, Kansas area is also included.

Table 3.3 – Drive-Through Coffee Shop Maximum Queue Statistics

	Minnesota Data	Minnesota + Kansas Data
Number of Data Points	14	26
Average Maximum Queue (Vehicles)	11.00	10.23
Standard Deviation (Vehicles)	2.25	2.76
Coefficient of Variation	20%	27%
Range (Vehicles)	7 to 16	3 to 16
85th Percentile (Vehicles)	13.50	13.00
33rd Percentile (Vehicles)	10.00	9.91

Queuing Video Observations - Burnside Kaady Car Wash 11/18/2025 (Tuesday)

Time	Patrons	Max Queue
8:00 AM	14	1
9:00 AM	16	1
10:00 AM	19	2
11:00 AM	17	2
12:00 PM	8	1
1:00 PM	21	2
2:00 PM	13	2
3:00 PM	19	2
4:00 PM	7	1
5:00 PM	14	2
6:00 PM	6	2
7:00 PM	3	1

Queuing Video Observations - Burnside Kaady Car Wash 11/22/2025 (Saturday)

Time	Patrons	Max Queue
8:00 AM	8	1
9:00 AM	20	3
10:00 AM	21	2
11:00 AM	14	2
12:00 PM	14	2
1:00 PM	19	3
2:00 PM	21	2
3:00 PM	20	2
4:00 PM	15	3
5:00 PM	4	1
6:00 PM	5	1
7:00 PM	7	1

Queuing Video Observations - Tualatin Sherwood Rd Kaady Car Wash 11/15/2025-11/16/2025 (Sat/Sun)

Time	Patrons	Max Queue	Notes
11/15/025			
1:00 PM	43	4	
2:00 PM	21	3	
3:00 PM	28	3	
4:00 PM	18	2	
5:00 PM	5	1	
6:00 PM	8	2	
7:00 PM	3	1	
11/16/2025			
8:00 AM	3	1	Rain
9:00 AM	2	1	Rain
10:00 AM	3	1	Rain
11:00 AM	2	1	Rain
12:00 PM	14	2	Rain

Queuing Video Observations - Tualatin Sherwood Rd Kaady Car Wash 11/18/2025 (Tuesday)

Time	Patrons	Max Queue
8:00 AM	16	2
9:00 AM	13	2
10:00 AM	13	3
11:00 AM	15	2
12:00 PM	29	4
1:00 PM	19	4
2:00 PM	30	4
3:00 PM	28	3
4:00 PM	17	3
5:00 PM	11	2
6:00 PM	3	1
7:00 PM	3	1
Total	**197**	

Queuing Video Observations - Tualatin Sherwood Rd Kaady Car Wash 11/22/2025 (Saturday)

Time	Patrons	Max Queue
8:00 AM	11	2
9:00 AM	12	2
10:00 AM	14	3
11:00 AM	19	3
12:00 PM	28	3
1:00 PM	18	2
2:00 PM	16	2
3:00 PM	12	3
4:00 PM	7	2
5:00 PM	7	1
6:00 PM	8	1
7:00 PM	3	1

18850 Willamette Drive Car Wash

Queue Calculation Worksheet (Assumes Poisson Distrubution of Arrivals)

Average Arrival Rate (λ)	60	veh/hour
Service Time	40	seconds/vehicle
Service Rate (μ)	90	veh/hour

Utilization (ρ)

= (λ)/(μ) 0.666667

Average Queue Length*

= (ρ^2)/(1-ρ) 1.3 vehicles

95th Percentile Queue*

= (log .05) / log (ρ) 7.4 vehicles

*The queue length calculations reflect a high estimate of Saturday peak demand.
Typical queue lengths are projected to be less than those calculated here.