

JEFFERSON COUNTY, WA



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TABLE OF CONTENTS

I.	Introduction	3
II.	Project Description	3
III.	Existing Conditions	5
IV.	Future Traffic Conditions	7
V.	Conclusions	17

LIST OF TABLES

1.	2021 Queue Lengths	10
2.	2031 Queue Lengths	14

LIST OF FIGURES

1.	Hood Canal Bridge Vicinity Map	4
2.	Wednesday 2021 Queue Lengths	11
3.	Friday 2021 Queue Lengths	11
4.	Saturday 2021 Queue Lengths	12
5.	Sunday 2021 Queue Lengths	12
6.	Wednesday 2031 Queue Lengths	15
7.	Friday 2031 Queue Lengths.	15
8.	Saturday 2031 Queue Lengths	16
9.	Sunday 2031 Queue Lengths	16

Appendix Data, For Each Day of Week:

90th Percentile Existing Hourly Volumes and Vehicle Type Percentages Existing, 2021, and 2031 Volumes 2021 Queues 2031 Queues

I. INTRODUCTION

Vehicular travel is an indirect yet important and dynamic element of new development which affects existing street networks and intersections near a project site. New development, such as residential subdivisions or commercial projects, typically translate into added vehicle trips on adjacent roadways which often causes an increase in traffic congestion to the local area. This study serves to examine traffic impacts related to the proposed Fred Hill Materials Central Conveyor & Pier project. The main goals of this study focus on the assessment of existing traffic conditions and congestion on the Hood Canal Bridge, forecasts of future traffic levels, estimations of future project ship activity through the Hood Canal, and estimations of future queues during potential bridge closures. The first task includes the collection of general roadway information, road improvement information, and hourly traffic counts. Next, future volume levels were determined for applicable horizon years. Following this forecast, a time of day analysis was performed to determine potential queues from bridge openings, and optimal operational times for project ship activity in order to minimize traffic impacts. As a final step, appropriate conclusions and possible mitigation measures are defined.

II. PROJECT DESCRIPTION

The proposed project is a conveyor and pier to move sand and gravel from the Thorndyke Resource Operations Complex (T-ROC) hub to Hood Canal for marine transport by barges and ships. The general project site is located in Jefferson County, to the west of the Hood Canal Bridge. Figure 1 on the following page provides a general site map of the vicinity, and shows the WSDOT traffic camera locations.

The project will have multiple components, including an increase in mining extraction rates from the marine transport capacity, a reconfiguration of the Operations Hub at the Shine Pit, a central conveyor connecting the Operations Hub to the pier, and the pier which will be located on the Olympic Peninsula side of Hood Canal, roughly five miles south of the Hood Canal Bridge and one mile northeast of Thorndyke Bay. Finally, barges and ships up to Panamax class will provide marine transport of the sand and gravel to local, regional, intrastate, and interstate markets.

Sand and gravel extraction would be from the Wahl and Meridian extraction areas. Pier operations would be limited to barge transport for the first 8 to 12 years, after which ship transport is expected to become available. Barges are low enough to pass under the Hood Canal Bridge without requiring the bridge to be opened. Ships would require the bridge to be opened, however.



III. EXISTING CONDITIONS

A. Surrounding Roadway Network

The primary road of interest is SR-104, which runs between US-101 and Kingston, and includes the Hood Canal Bridge. The typical cross section is two 12 foot lanes plus 8 foot shoulders on the bridge. The posted speed limit ranges from 40 mph on the bridge to 60 mph west of the bridge. Pedestrian and bicycle crossings are permitted.

The other road of interest is *SR-3*, which begins on the east side of the Hood Canal Bridge and runs southerly towards Shelton. The cross section in the bridge vicinity is typically two 12 foot lanes plus 8 foot shoulders. The speed limit is 45 mph just south of the bridge, transitioning to 55 mph further south.

B. Roadway Improvements

The WSDOT projects list indicates a future improvement to the Hood Canal Bridge of shoulder enhancements for bicyclists and pedestrians. The project is to go out to bid in 2012.

A review of the latest (2011-2016) Kitsap County Six-Year Transportation Improvement Program (TIP) indicates no improvement projects in the bridge vicinity. A review of the 2012-2017 Jefferson County Six Year TIP also indicates no improvement projects in the vicinity.

C. Existing Hourly Volumes

Field data for this study was collected from the WSDOT permanent traffic recorder R085, located on SR-104 at the Hood Canal Bridge at milepost 13.92. Traffic count data used in this report is from January 1, 2007 through April 30, 2011. Data includes hourly volumes for both the eastbound and westbound directions, as well as vehicle class. The raw data was processed to determine the average volumes, various percentile volumes, and vehicle classification for each hour of day for each day of week over the 5-year span. This analysis will focus on the 90th percentile volumes for each hour of day, and each day of week. The 90th percentile provides statistical volumes that are much higher than the typical average volumes, and is higher than the 85th percentile typically used in traffic applications. It should be noted that if too high of a percentile is used, there is a risk of influence from anomalous data such as high volumes from the days before scheduled bridge closures, hourly volumes that are higher than normal due to a bridge closure in the previous hour, or holidays (which are not relevant since barge and ship loading would not occur, see Section IV Part A below). Note that since calculations are performed individually for each hour of day, the sum of the 90th percentile volumes per hour for each of the 24 hours of a day will be higher than most continuous 24 hour days from the raw data. Summaries of the peak hourly volumes per direction and day of week can be found in the appendix.

D. Existing Bridge Operations

The Hood Canal Bridge has the capacity to open a single draw span for 300 feet of opening, or both draw spans for a 600 foot opening. The opening procedure takes less time than the closing procedure, due to additional time required for realignment of the spans when closing. The typical total time for the full bridge opening/closing procedure (traffic gates down to traffic gates up) is 25 to 30 minutes for ships crossing under their own power, or 30 to 40 minutes for a tug and tow crossing (when height or width precludes crossing without having to open the bridge). The times can vary depending on tide conditions, as the cables are stretched out more during high and low tides. The crossing speed for marine traffic is asked to be held to 7 knots. Requests for bridge openings must give at least 1 hour notice. Current data indicates approximately 32 bridge openings per month for marine vessels. Openings for Navy vessels are not recorded, although SR-104 closure times can be substantially longer for Navy ship crossings.

The Hood Canal Bridge Project was completed in 2010 by the Washington State Department of Transportation (WSDOT). In 2008, the east half of the Hood Canal Bridge was replaced as part of an overall structural upgrade, bridge widening and improved draw span design and function. The west half was then retrofitted so that the hydraulic, electrical and mechanical systems matched the new east half. There were numerous bridge closures throughout the project. The bridge is currently two lanes (capable of four) with wide shoulders.

WSDOT operates the Hood Canal Bridge under license *No. 105c-80-13* from the U.S. Coast Guard. Federal law requires that WSDOT open the bridge for all requests by ship captains. Bridge safety and navigation fall under federal legislation (*see U.S. Coast Guard Bridge Administration Commandant Publication P16591.3B*) and are the exclusive domain of the U.S. Coast Guard. The Rivers and Harbors Act of 1899, the General Bridge Act of 1946 and subsequent Acts and amendments preserve the public right of navigation and prevent interference with interstate and foreign commerce. The authority granted to the Secretary of Transportation pertaining to bridges and causeways over U.S. navigable waters was delegated in 1967 to the Commandant, U.S. Coast Guard (*Department of Transportation Order 1100.1 dated 31 March 1967 (49 CFR 1.46(c)*).

As such, the navigable waters of the United States are under the exclusive control of the Coast Guard to prevent any interference with their navigability by bridges or other obstructions except by express permission of the U.S. government. A recent example (2011) was evidenced when WSDOT requested the Coast Guard to prohibit Hood Canal Bridge openings during afternoon commuter hours (3 PM to 6 PM). The Coast Guard granted the request under trial conditions for a few months, with the trial period ending on September 30. Analysis done in this report presumes that this prohibition will become permanent, pending test results and feedback on the trial program.

IV. FUTURE TRAFFIC CONDITIONS

A. Pier Transport Activity

As mentioned previously, transport for the first 8 to 12 years of pier operation is expected to be via barges with tugs. Barges would be required by contract to cross the Hood Canal Bridge under the 230 foot eastern span, and not require a bridge opening. As such, barge activity would have no impact to vehicular traffic crossing the bridge. The typical barge capacity would be around 5,000 dwt. The loading time for such a barge would be roughly 2 to 3 hours. Barge transport would be in operation 24 hours a day, seven days a week, and 300 days a year. Up to 6 barges a day could be berthed and processed, resulting in up to 12 barge crossings a day under the eastern span.

The ships required for transport of sand and gravel at the proposed pier are currently not available in this region. The Thorndyke Resource project application limits itself to a maximum berthing of six ships (12 bridge openings) each month, when such ships do become available on the West Coast, and further stipulates that "only ships will require opening of the Hood Canal Bridge." The Applicant also states that all captains of tugs and barges calling on the proposed pier are required to transect the bridge under its eastern span (Kitsap County end), and expressly prohibits tugs and barges to compel bridge openings. Furthermore, the application excludes Pier use 65 days annually for holidays, tribal fishing, inclement weather and periods of non-use. Analysis done in this report incorporates these project limitations.

After 8 to 12 years, market conditions and activity are expected to be such that the required ships would become available. Ships up to Panamax class, which is up to 110 feet wide and 745 feet long, could be used. The capacity of a Panamax class ship would be up to roughly 65,000 dwt. The time due to loading at the pier would result in turnaround times of up to 24 hours for the Panamax class, or as low as 8 hours for a smaller ship of 20,000 dwt capacity.

Some comments received by Jefferson County during its scoping process focused on the likelihood of vessels calling on the proposed pier hitting and damaging the bridge. The Coast Guard defines the act of vessels (moving object) hitting a bridge (stationary object) as an "allision" (*Coast Guard-American Waterways Operators Bridge Allision Work Group Report, 2003*).

Bridge allisions are not a presumed condition of this report and are outside the scope of this report, which pertains to county and state jurisdictions. The Coast Guard will review the proposed project as part of the U.S. Army Corps of Engineers (COE) permit application for determination of any required condition and/or mitigating measure to assure compliance with applicable regulations.

B. Future Traffic Volumes

For this project the horizon analysis years of 2021 and 2031 were chosen for 10 year and 20 year outlooks. The 10 year horizon represents the start of ship transport for the pier. Traffic volumes for the horizon years was taken by applying a 1 percent annual growth rate to the 90th percentile volumes obtained from the existing counts of SR-104 at the Hood Canal Bridge. This annual growth rate should be a conservative estimate, as WSDOT data indicates no growth over the past 4 years. Refer to the WSDOT Annual Traffic Report at the back of the appendix. However, a rate of 1 percent was chosen in order to incorporate some future growth.

C. Queue Model

The queue analysis was performed to determine the extent of traffic backups for a typical 30 minute bridge opening during higher than average traffic volumes. As noted above, this study uses 90th percentile volumes for each hour of day and day of week, using the last 5 years of WSDOT data from the automated counter. A Panamax class ship is larger than average, however with a crossing speed of 7 knots and 750 foot in length, a Panamax ship would cross the bridge itself in just over a minute. As noted previously, the bridge span operations, especially closing (due to alignment issues), are the key factor in the time duration during which the bridge is closed to traffic. A 30 minute opening is assumed for this analysis, on the high end of the 25-30 minute range.

The queue analysis takes into account the percentage of each design vehicle, assigning lengths based on AASHTO design vehicle specifications. The vehicle types are: Passenger Vehicle (P design vehicle), Single Unit Truck (SU design vehicle), Double Unit Truck (WB50 design vehicle), and Triple Unit Truck (WB67D design vehicle). The assumed lengths for vehicle spacing (front of bumper to the following front of bumper) are: Passenger Vehicles (including motorcycles) 25 feet, SU Trucks 45 feet, DU Trucks 70 feet, TU Trucks 90 feet. Base queue calculations for the 30 minute bridge opening were calculated by multiplying the 90th percentile hourly numbers of vehicles by the vehicle lengths, then dividing by 2 to get the queue for a 30 minute bridge opening period instead of the full hour.

Additional queuing continues after the gates are lifted, as traffic does not instantaneously start moving at the back of the queue. Instead, there is a "wave" that occurs from the start of the queue moving backwards as the cars start moving and accelerating. A queue departure wave at an isolated signal was assumed to have a constant speed of 19.4 ft/s based on observations of queue departure waves by Akcelik and Besley in their report *Queue Discharge Flow and Speed Models for Signalized Intersections*. In this bridge queue analysis, however, a lower speed of 15 ft/s was chosen due to assumptions of additional time for vehicles restarting engines and drivers possibly having a longer reaction time than at a traffic signal. The additional time for the wave to reach the back of the queue (which has meanwhile been increasing) was calculated, then the additional queue accrued during this time was calculated. Naturally, the longer the base queue, the

longer the discharge wave takes to reach the back of the queue. This significant extra time in addition to the 30 minutes assumed during which the bridge is closed, adds up to the point that peak hour factors were not employed in these calculations. Peak hour factors are used for shorter intervals, typically 15 minutes.

Eastbound queues accumulate on the bridge and continue back on SR-104 into Jefferson County. Westbound queues, however, typically extend past the bridge to the SR3/SR-104 intersection. Beyond this intersection, queues stack up to the southwest on SR-3 towards Silverdale and to the northeast on SR-104 towards Port Gamble. Observations indicate queue splits of roughly 85% on SR-3 and 15% on SR-104. These percentages were incorporated into the queue model.

The queue model was entered into an excel spreadsheet, and was then calibrated to approximate existing queues noted in the WSDOT traffic cameras during bridge openings. The specific bridge opening duration for the calibration queue was obtained from the Hood Canal Bridge Supervisor's office. The specific traffic volumes during this period were not known but assumed based on the previous 5 years' worth of collected data. The primary model adjustment in this calibration process was lowering the queue departure wave speed to 15 ft/s, mentioned above.

D. Queue Analysis Results

The spreadsheet queue model was applied for each hour for each day of week for the 2021 and 2031 horizon years. Queue output sheets may be found in the appendix. Table 1 on the following page gives the expected queue lengths in feet for the 2021 horizon year. Wednesday was chosen to represent a typical weekday. Data for Monday, Tuesday, and Thursday is not shown in the table for space reasons, but can be found in the appendix. The WB to S and WB to N values represent the westbound queue splits from the SR-3/SR-104 intersection, with WB to S for SR-3 queues towards Silverdale and WB to N for SR-104 queues towards Port Gamble. As the westbound queuing focus is on the split queues on SR-3 and SR-104, the queues from the gates to the SR-3/SR-104 intersection 3200 feet away are not shown. Total westbound queue lengths under 3200 feet correspondingly show up as 0 in the WB to S and WB to N columns. Total westbound queues incorporating this length can be found in the appendix sheets. Line charts for 2021 queues are also provided in Figures 2 through 5. Please note that the queue lengths and data points are not for the specific point in time for the hour of day, but represent the calculated queues for the full hour. For example, the Wednesday peak queue length of 17192 feet is calculated for the hour long period from 10 AM to 11 AM.

The 2021 queue results in Table 1 tend to show more pronounced peaking for the westbound direction than the eastbound direction. It should be noted that the volume data also typically showed higher daily volumes for the westbound direction than the eastbound direction, except for on Sundays. This could be due to tourist volumes leaving the peninsula at the end of the weekend.

	1			I			1			I		
Chartina		Wednesday			Friday			Saturday			Sunday	
Hour	EB	WB to S	WB to N	EB	WB to S	WB to N	EB	WB to S	WB to N	EB	WB to S	WB to N
12 AM	478	0	0	561	0	0	661	0	0	862	0	0
1 AM	331	0	0	412	0	0	434	0	0	480	0	0
2 AM	544	0	0	555	0	0	503	0	0	364	0	0
3 AM	1161	0	0	1089	0	0	554	0	0	369	0	0
4 AM	2717	0	0	2730	0	0	941	0	0	614	0	0
5 AM	5470	0	0	4586	0	0	1603	0	0	1066	0	0
6 AM	9471	3355	592	8282	2305	407	3264	401	71	1794	0	0
7 AM	12766	5566	982	10707	5089	898	6293	3158	557	3965	182	32
8 AM	13751	6313	1114	12698	5581	985	10013	5831	1029	7013	775	137
9 AM	16759	6841	1207	16025	7420	1309	16030	10292	1816	13442	4840	854
10 AM	17912	8994	1587	20099	11606	2048	18823	17116	3020	21092	8740	1542
11 AM	16701	10246	1808	19531	14413	2543	19673	23182	4091	25856	12490	2204
12 PM	15682	11687	2062	18782	15872	2801	17034	20215	3567	26564	13676	2413
1 PM	16571	11526	2034	18819	17042	3007	16759	20166	3559	29827	12866	2270
2 PM	16404	11936	2106	19968	21351	3768	17024	17116	3020	28339	11713	2067
3 PM	16142	14514	2561	18480	21870	3859	17644	16343	2884	28950	11311	1996
4 PM	15406	15432	2723	17272	23696	4182	20018	13566	2394	30378	10788	1904
5 PM	12828	10419	1839	15782	20358	3593	19258	9819	1733	26926	8734	1541
6 PM	9554	7894	1393	12966	14718	2597	16247	7975	1407	20538	9013	1591
7 PM	6206	4497	794	8237	11661	2058	12042	5452	962	14678	5865	1035
8 PM	4227	3073	542	5575	8269	1459	9451	3857	681	9887	3598	635
9 PM	2877	1745	308	3846	5650	997	6752	2335	412	5803	1775	313
10 PM	2137	0	0	2924	1976	349	4692	1204	212	3599	103	18
11 PM	832	0	0	1284	436	77	1956	0	0	1257	0	0

TABLE 12021 Queue Lengths





Figure 3







Figure 5



As expected, 90th percentile weekday queues in the AM would be more apparent for the eastbound direction, following the majority of commuter traffic. Eastbound queues would start to become pronounced at roughly 6 AM, increasing every hour until the 10-11 AM period, after which the eastbound queues would start to taper down. Westbound queues would hold steady roughly from this point until increasing substantially at 3 PM through 5 PM, and tapering off after 6 PM.

90th percentile queues would be substantially higher on Friday than during the normal weekdays. Again, AM queuing would be mostly in the eastbound direction particularly starting at 6 AM. Periods of the longest queues would begin roughly around 10 AM and continue to 6 PM, although the westbound queues would show continued increases from the late morning until the peak at 5 PM, without a midday lull.

Saturday eastbound queues would show a peak between 10 AM and 12 AM followed by a pronounced lull, then another peak between 4 PM and 6 PM. Westbound queues show a single peak roughly between 10 AM and 2 PM. The interplay between the two directions results in a lull in overall midday traffic between 2 PM and 4 PM.

Sunday eastbound queues appear to represent the highest expected queuing in the analysis, especially from 10 AM through 7 PM. Westbound queues on Sunday are substantially lower in comparison, with peaks from 11 AM to 5 PM.

Table 2 on the following page shows the expected 90th percentile queue lengths for the 2031 horizon year, while Figures 6 through 9 show the 2031 daily queues in line charts. 2031 shows the same peaking intervals as in 2021, however the queues are naturally higher from the additional years over which the annual growth rate is applied.

Most of the largest queues show an increase of roughly 15 to 20 percent for the 2031 horizon year over the 2021 horizon year. The anticipated higher vehicles per hour rate compounds the queue length due to the additional time required for the back of the queue to start moving, during which the queue continues to accrue. This effect is less pronounced for shorter queues. Also note that the 2031 analysis assumes continual growth and no road improvements for a worst case analysis.

	Wednesday			Friday				Saturday		Sunday		
Starting Hour	EB	WB to S	WB to N	EB	WB to S	WB to N	EB	WB to S	WB to N	EB	WB to S	WB to N
12 AM	529	0	0	621	0	0	732	0	0	955	0	0
1 AM	367	0	0	456	0	0	480	0	0	531	0	0
2 AM	602	0	0	615	0	0	557	0	0	403	0	0
3 AM	1288	0	0	1208	0	0	613	0	0	408	0	0
4 AM	3033	0	0	3048	0	0	1043	0	0	680	0	0
5 AM	6174	232	41	5157	74	13	1781	0	0	1182	0	0
6 AM	10860	4182	738	9451	2961	522	3652	777	137	1995	0	0
7 AM	14836	6793	1199	12339	6225	1098	7126	3952	697	4449	528	93
8 AM	16045	7686	1356	14752	6810	1202	11507	7109	1254	7964	1204	212
9 AM	19799	8322	1469	18874	9023	1592	18880	12560	2216	15665	5929	1046
10 AM	21262	10950	1932	24077	14211	2508	22428	21369	3771	25373	10637	1877
11 AM	19725	12503	2206	23340	17809	3143	23524	29723	5245	31741	15334	2706
12 PM	18443	14313	2526	22375	19719	3480	20146	25573	4513	32710	16854	2974
1 PM	19560	14109	2490	22423	21271	3754	19798	25506	4501	37253	15814	2791
2 PM	19350	14629	2582	23907	27146	4790	20133	21369	3771	35165	14346	2532
3 PM	19020	17940	3166	21988	27872	4919	20920	20341	3590	36019	13838	2442
4 PM	18098	19140	3378	20448	30455	5374	23971	16713	2949	38033	13180	2326
5 PM	14911	12718	2244	18569	25769	4548	22989	11971	2113	33208	10629	1876
6 PM	10960	9601	1694	15080	18206	3213	19153	9700	1712	24648	10973	1936
7 PM	7024	5523	975	9399	14280	2520	13953	6656	1175	17191	7150	1262
8 PM	4747	3852	680	6294	10059	1775	10836	4770	842	11357	4466	788
9 PM	3214	2315	408	4312	6893	1216	7659	2995	529	6558	2349	415
10 PM	2380	111	20	3267	2581	455	5279	1693	299	4032	439	78
11 PM	922	0	0	1426	817	144	2177	104	18	1396	0	0

TABLE 22031 Queue Lengths





Figure 7







Figure 9



V. CONCLUSIONS

The Fred Hill Materials Central Conveyor and Pier project is to be located to the southwest of the Hood Canal Bridge on the Jefferson County side. The completed project will begin sand and gravel transport via barge, with no bridge crossing impacts to traffic. Within 8 to 12 years, ships up to Panamax class will be expected to begin transport to and from the proposed pier. These ships would require openings of the Hood Canal Bridge of roughly 30 minutes each trip, with a turnaround cycle time of 24 hours. Ship activity for this project would require 12 bridge openings a month: 6 inbound trips and 6 outbound trips.

In order to assess the impacts to vehicular traffic, a queuing model was employed using data from a WSDOT automated counter at the bridge. Queuing activity was based on 90th percentile hourly volumes for each day of week, with annual increases in volumes expected through the 2021 and 2031 horizon years. The model output could then be used to determine the hours during which bridge openings could cause the least impacts to vehicular traffic on SR-104.

The results of the data are as follows:

- Monday through Thursday weekdays would have the least impact for the window roughly from 6 PM through 6 AM, with a midday lull in traffic from 11 AM to 3 PM. (Peaks from 6 AM to 11 AM, 3 PM to 6 PM)
- Fridays would also have the lowest queues before 6 AM and after 6 PM, however there would be no appreciable midday lull in traffic. (Peak from 6 AM to 6 PM)
- Saturday impacts would be the lowest before 10 AM and after 7 PM, with a midday lull between 2 PM and 4 PM. However, it should be noted that queues during this lull would exceed the peak overall queues on a typical weekday due to the increased volumes. (Peaks from 10 AM to 2 PM, 4 PM to 7 PM)
- Sunday impacts would be lowest before 10 AM and after 7 PM, with potentially the highest 90th percentile volumes of the week for the eastbound direction between those hours. (Peak from 10 AM to 7 PM)

The above peak times could be used to coordinate ship activity for the pier in order to target certain time periods for Hood Canal Bridge openings. The project applicant is proposing to only open the bridge for ships during non-peak hours. Bridge openings during the non-peak hours would minimize impacts so as to not have a substantial impact on queuing and commuter traffic patterns.

APPENDIX

SR-104 Monday 90th Percentile Hourly Volumes

	Existing Volumes				EB Vehicle	es by Type		WB Vehicles by Type			
	EB	WB	Total	% Cars	% SU	% DU	% TU	% Cars	% SU	% DU	% TU
12 AM	32	78	110	0.92	0.03	0.04	0.01	0.9	0.03	0.07	0
1 AM	21	45	66	0.89	0.07	0.02	0.02	0.85	0.08	0.06	0.01
2 AM	25	27	52	0.84	0.04	0.12	0	0.72	0.09	0.15	0.04
3 AM	62	29	91	0.72	0.05	0.22	0.01	0.69	0.15	0.13	0.03
4 AM	178	52	230	0.89	0.04	0.03	0.04	0.58	0.25	0.15	0.02
5 AM	307	158	465	0.91	0.06	0.03	0	0.79	0.1	0.1	0.01
6 AM	439	291	730	0.92	0.04	0.04	0	0.78	0.12	0.07	0.03
7 AM	517	387	904	0.93	0.06	0.01	0	0.82	0.08	0.08	0.02
8 AM	547	417	964	0.94	0.05	0.01	0	0.82	0.09	0.08	0.01
9 AM	625	469	1094	0.92	0.05	0.02	0.01	0.81	0.1	0.07	0.02
10 AM	708	559	1267	0.94	0.04	0.02	0	0.84	0.1	0.05	0.01
11 AM	725	616	1341	0.94	0.05	0.01	0	0.87	0.06	0.06	0.01
12 PM	673	631	1304	0.94	0.05	0.01	0	0.87	0.06	0.06	0.01
1 PM	682	615	1297	0.95	0.04	0.01	0	0.87	0.07	0.05	0.01
2 PM	656	641	1297	0.95	0.04	0.01	0	0.89	0.05	0.05	0.01
3 PM	661	727	1388	0.95	0.04	0.01	0	0.91	0.06	0.02	0.01
4 PM	657	752	1409	0.95	0.04	0.01	0	0.92	0.05	0.03	0
5 PM	590	657	1247	0.94	0.05	0.01	0	0.94	0.05	0.01	0
6 PM	485	513	998	0.96	0.03	0.01	0	0.94	0.05	0.01	0
7 PM	341	378	719	0.95	0.04	0.01	0	0.94	0.04	0.02	0
8 PM	247	328	575	0.95	0.04	0.01	0	0.95	0.03	0.02	0
9 PM	174	254	428	0.95	0.04	0.01	0	0.95	0.04	0.01	0
10 PM	131	149	280	0.97	0.02	0.01	0	0.89	0.06	0.05	0
11 PM	49	128	177	0.92	0.06	0.02	0	0.93	0.03	0.03	0.01

Total	9532	8901	18433
rotar	JJJ2	0001	T0400

SR-104 Monday Horizon Year 90th Percentile Hourly Volumes

	Existi	ing Volum	es	202	21 Volum	es	2031 Volumes			
	EB	WB	Total	EB	WB	Total	EB	WB	Total	
12 AM	32	78	110	35	86	122	39	95	134	
1 AM	21	45	66	23	50	73	26	55	81	
2 AM	25	27	52	28	30	57	31	33	63	
3 AM	62	29	91	68	32	101	76	35	111	
4 AM	178	52	230	197	57	254	217	63	281	
5 AM	307	158	465	339	175	514	375	193	567	
6 AM	439	291	730	485	321	806	536	355	891	
7 AM	517	387	904	571	427	999	631	472	1103	
8 AM	547	417	964	604	461	1065	667	509	1176	
9 AM	625	469	1094	690	518	1208	763	572	1335	
10 AM	708	559	1267	782	617	1400	864	682	1546	
11 AM	725	616	1341	801	680	1481	885	752	1636	
12 PM	673	631	1304	743	697	1440	821	770	1591	
1 PM	682	615	1297	753	679	1433	832	750	1583	
2 PM	656	641	1297	725	708	1433	800	782	1583	
3 PM	661	727	1388	730	803	1533	807	887	1694	
4 PM	657	752	1409	726	831	1556	802	918	1719	
5 PM	590	657	1247	652	726	1377	720	802	1522	
6 PM	485	513	998	536	567	1102	592	626	1218	
7 PM	341	378	719	377	418	794	416	461	877	
8 PM	247	328	575	273	362	635	301	400	702	
9 PM	174	254	428	192	281	473	212	310	522	
10 PM	131	149	280	145	165	309	160	182	342	
11 PM	49	128	177	54	141	196	60	156	216	
Total	9532	8901	18433	10529	9832	20361	11631	10861	22492	

SR-104 Monday 2021 Horizon Year Queues

		2021 East	tbound			2021 We				
	Base Q	added t	added Q	Total Q	Base Q	added t	added Q	Total Q	Q to S	Q to N
12 AM	496	34	9	505	1239	87	60	1298	0	0
1 AM	332	22	4	336	744	51	21	765	0	0
2 AM	431	29	7	438	539	37	11	550	0	0
3 AM	1252	87	61	1312	573	39	12	586	0	0
4 AM	2925	219	355	3280	1093	76	46	1139	0	0
5 AM	4671	377	977	5649	2806	209	325	3131	0	0
6 AM	6692	593	2205	8897	5223	432	1253	6476	2785	491
7 AM	7610	706	2986	10596	6733	598	2237	8970	4904	865
8 AM	7991	757	3359	11350	7151	649	2576	9728	5549	979
9 AM	9510	979	5171	14681	8147	778	3520	11667	7197	1270
10 AM	10441	1135	6583	17024	9231	935	4796	14027	9203	1624
11 AM	10591	1162	6836	17428	10054	1068	5964	16018	10895	1923
12 PM	9832	1031	5630	15462	10298	1110	6350	16649	11431	2017
1 PM	9888	1040	5713	15601	9952	1051	5810	15763	10678	1884
2 PM	9511	979	5172	14683	10232	1098	6243	16474	11283	1991
3 PM	9583	990	5273	14856	11142	1265	7829	1897 2	13406	2366
4 PM	9525	981	5192	14717	11359	1307	8250	19610	13948	2461
5 PM	8619	844	4042	12661	9598	993	5294	14891	9938	1754
6 PM	6978	627	2432	9410	7494	692	2879	10374	6098	1076
7 PM	4944	403	1108	6052	5574	468	1450	7024	3251	574
8 PM	3581	275	548	4129	4801	389	1038	5839	2243	396
9 PM	2523	186	260	2783	3683	284	582	4264	905	160
10 PM	1870	134	139	2010	2341	171	222	2564	0	0
11 PM	733	50	20	754	1951	140	152	2103	0	0

Base Q = queue formed after 30 minutes (gates closed to gates open)

added t = time for queue discharge wave to reach the back of the growing queue

added Q = additional queue length formed until the wave reaches the back

Total Q = Base Q + added Q

Q to S = westbound queue split extending to the southwest on SR-3

Q to N = westbound queue split extending to the northeast on SR-104

Note: a westbound Total Q under 3200 feet does not extend past the SR3/SR104 intersection

SR-104 Monday 2031 Horizon Year Queues

		2031 East	tbound			2031 We	stbound			
	Base Q	added t	added Q	Total Q	Base Q	added t	added Q	Total Q	Q to S	Q to N
12 AM	548	37	11	559	1368	96	73	1441	0	0
1 AM	366	25	5	371	822	57	26	848	0	0
2 AM	476	32	9	484	595	41	13	609	0	0
3 AM	1383	97	_, 75	1457	633	43	15	649	0	0
4 AM	3231	245	439	3670	1207	84	56	1264	0	0
5 AM	5160	425	1219	6379	3099	233	402	3501	256	45
6 AM	7392	679	2787	10179	5770	489	1568	7338	3517	621
7 AM	8406	814	3800	12206	7437	684	2828	10265	6005	1060
8 AM	8827	874	4287	13114	7899	744	3267	11166	6771	1195
9 AM	10505	1146	6690	17195	8999	900	4499	13498	8753	1545
10 AM	11533	1342	8600	20133	10197	1092	6188	16386	11208	1978
11 AM	11699	1376	8946	20645	11105	1258	7759	18865	13315	2350
12 PM	10860	1211	7308	18168	11376	1311	8283	19659	13990	2469
1 PM	10922	1223	7420	18342	10994	1236	7551	18544	13043	2302
2 PM	10506	1146	6692	17197	11302	1296	8137	19439	13803	2436
3 PM	10586	1161	6827	17413	12308	1508	10311	22620	16507	2913
4 PM	10522	1149	6719	17240	12548	1563	10895	23443	17206	3036
5 PM	9521	980	5186	14707	10602	1164	6855	17457	12118	2139
6 PM	7708	719	3080	10788	8278	796	3660	11939	7428	1311
7 PM	5461	456	1385	6846	6157	532	1819	7977	4060	716
8 PM	3956	309	679	4635	5303	440	1296	6599	2889	510
9 PM	2787	207	321	3107	4068	319	722	4789	1351	238
10 PM	2066	149	171	2237	2586	191	274	2860	0	0
11 PM	810	56	25	835	2155	156	187	2342	0	0

Base Q = queue formed after 30 minutes (gates closed to gates open)

added t = time for queue discharge wave to reach the back of the growing queue

added Q = additional queue length formed until the wave reaches the back

Total Q = Base Q + added Q

Q to S = westbound queue split extending to the southwest on SR-3

Q to N = westbound queue split extending to the northeast on SR-104

Note: a westbound Total Q under 3200 feet does not extend past the SR3/SR104 intersection

SR-104 Tuesday 90th Percentile Hourly Volumes

	Existi	ng Volum	es 🛛		EB Vehicle	es by Type		WB Vehicles by Type			
	EB	WB	Total	% Cars	% SU	% DU	% TU	% Cars	% SU	% DU	% TU
12 AM	25	77	102	0.77	0.1	0.12	0.01	0.94	0.03	0.03	0
1 AM	19	45	64	0.73	0.16	0.11	0	0.89	0.04	0.06	0.01
2 AM	24	30	54	0.65	0.09	0.2	0.06	0.83	0.02	0.1	0.05
3 AM	56	25	81	0.69	0.05	0.24	0.02	0.78	0.11	0.07	0.04
4 AM	156	45	201	0.86	0.06	0.06	0.02	0.53	0.27	0.14	0.06
5 AM	289	145	434	0.86	0.09	0.04	0.01	0.73	0.13	0.11	0.03
6 AM	447	287	734	0.88	0.07	0.03	0.02	0.76	0.12	0.09	0.03
7 AM	519	389	908	0.87	0.07	0.04	0.02	0.79	0.1	0.09	0.02
8 AM	582	424	1006	0.85	0.07	0.06	0.02	0.78	0.11	0.09	0.02
9 AM	635	480	1115	0.86	0.08	0.05	0.01	0.83	0.09	0.07	0.01
10 AM	659	548	1207	0.88	0.06	0.05	0.01	0.84	0.09	0.06	0.01
11 AM	630	589	1219	0.87	0.07	0.05	0.01	0.87	0.07	0.06	0
12 PM	612	635	1247	0.87	0.07	0.05	0.01	0.86	0.06	0.06	0.02
1 PM	616	591	1207	0.87	0.08	0.04	0.01	0.88	0.07	0.04	0.01
2 PM	603	625	1228	0.87	0.08	0.04	0.01	0.88	0.07	0.04	0.01
3 PM	616	755	1371	0.89	0.07	0.04	0	0.91	0.06	0.02	0.01
4 PM	630	767	1397	0.9	0.07	0.03	0	0.93	0.05	0.02	0
5 PM	558	670	1228	0.92	0.05	0.02	0.01	0.93	0.05	0.02	0
6 PM	440	551	991	0.94	0.04	0.02	0	0.94	0.04	0.02	0
7 PM	310	412	722	0.93	0.04	0.02	0.01	0.94	0.04	0.02	0
8 PM	232	343	575	0.93	0.05	0.02	0	0.93	0.04	0.02	0.01
9 PM	165	268	433	0.94	0.04	0.01	0.01	0.94	0.04	0.02	0
10 PM	117	155	272	0.91	0.04	0.03	0.02	0.94	0.04	0.02	0
11 PM	44	138	182	0.84	0.07	0.09	0	0.93	0.04	0.02	0.01

Total 8984 8994 17978

SR-104 Tuesday Horizon Year 90th Percentile Hourly Volumes

	Exist	ing Volum	ies	20	21 Volum	es	2031 Volumes			
	EB	WB	Total	EB	WB	Total	EB	WB	Total	
12 AM	25	77	102	28	85	113	31	94	124	
1 AM	19	45	64	21	50	71	23	55	78	
2 AM	24	30	54	27	33	60	29	37	66	
3 AM	56	25	81	62	28	89	68	31	99	
4 AM	156	45	201	172	50	222	190	55	245	
5 AM	289	145	434	319	160	479	353	177	530	
6 AM	447	287	734	494	317	811	545	350	896	
7 AM	519	389	908	573	430	1003	633	475	1108	
8 AM	582	424	1006	643	468	1111	710	517	1228	
9 AM	635	480	1115	701	530	1232	775	586	1361	
10 AM	659	548	1207	728	605	1333	804	669	1473	
11 AM	630	589	1219	696	651	1347	769	719	1487	
12 PM	612	635	1247	676	701	1377	747	775	1522	
1 PM	616	591	1207	680	653	1333	752	721	1473	
2 PM	603	625	1228	666	690	1356	736	763	1498	
3 PM	616	755	1371	680	834	1514	752	921	1673	
4 PM	630	767	1397	696	847	1543	769	936	1705	
5 PM	558	670	1228	616	740	1356	681	818	1498	
6 PM	440	551	991	486	609	1095	537	672	1209	
7 PM	310	412	722	342	455	798	378	503	881	
8 PM	232	343	575	256	379	635	283	419	702	
9 PM	165	268	433	182	296	478	201	327	528	
10 PM	117	155	272	129	171	300	143	189	332	
11 PM	44	138	182	49	152	201	54	168	222	
Total	8984	8994	17978	9924	9935	19859	10962	10974	21937	

SR-104 Tuesday 2021 Horizon Year Queues

		2021 Eastbound				2021 We				
	Base Q	added t	added Q	Total Q	Base Q	added t	added Q	Total Q	Q to S	Q to N
12 AM	456	31	8	464	1146	80	51	1197	0	0
1 AM	348	23	5	352	724	50	20	744	0	0
2 AM	526	36	10	537	549	37	11	561	0	0
3 AM	1178	82	54	1232	455	31	8	463	0	0
4 AM	2602	192	278	2880	1009	70	39	1048	0	0
5 AM	4669	376	976	5645	2763	205	315	3078	0	0
6 AM	7172	651	2594	9766	5294	439	1291	6586	2878	508
7 AM	8456	821	3856	12312	6950	624	2409	9360	5236	924
8 AM	9772	1021	5543	15315	7623	708	2999	10621	6308	1113
9 AM	10346	1118	6428	16774	8112	773	3484	11597	7137	1259
10 AM	10592	1162	6837	17429	9125	919	4659	13784	8996	1588
11 AM	10195	1092	6185	16380	9467	972	5111	14578	9671	1707
12 PM	9904	1043	5737	15641	10592	1162	6837	17429	12094	2134
1 PM	9883	1039	5707	15590	9417	964	5044	14461	9572	1689
2 PM	9675	1005	5403	15078	9959	1052	5820	15779	10692	1887
3 PM	9594	992	5289	14883	11572	1350	8679	20251	14493	2558
4 PM	9656	1002	5376	15031	11395	1314	8322	19717	14040	2478
5 PM	8491	826	3895	12385	9954	1051	5813	15767	10682	1885
6 PM	6489	569	2053	8541	8125	775	3498	11623	7160	1264
7 PM	4683	378	983	5665	6076	523	1764	7840	3944	696
8 PM	3447	263	504	3951	5181	427	1230	641 2	2730	482
9 PM	2451	180	245	2696	3952	309	678	4630	1215	214
10 PM	1838	132	134	1973	2286	166	211	2497	0	0
11 PM	740	51	21	761	2085	151	174	2259	0	0

Base Q = queue formed after 30 minutes (gates closed to gates open)

added t = time for queue discharge wave to reach the back of the growing queue

added Q = additional queue length formed until the wave reaches the back

Total Q = Base Q + added Q

Q to S = westbound queue split extending to the southwest on SR-3

Q to N = westbound queue split extending to the northeast on SR-104

Note: a westbound Total Q under 3200 feet does not extend past the SR3/SR104 intersection

SR-104 Tuesday 2031 Horizon Year Queues

		2031 Eastbound				2031 We				
	Base Q	added t	added Q	Total Q	Base Q	added t	added Q	Total Q	Q to S	Q to N
12 AM	504	34	10	514	1266	89	62	1328	0	0
1 AM	384	26	6	390	800	55	24	825	0	0
2 AM	581	40	13	594	607	41	14	621	0	0
3 AM	1302	91	66	1368	503	34	10	512	0	0
4 AM	2874	214	342	3217	1115	78	48	1163	0	0
5 AM	5157	425	1218	6375	3052	229	389	3441	205	36
6 AM	7922	747	3290	11212	5848	498	1617	7465	3625	640
7 AM	9341	952	4941	14282	7678	715	3051	10728	6399	1129
8 AM	10794	1199	7190	17984	8420	816	3816	12236	7680	1355
9 AM	11429	1321	8388	19817	8961	894	4452	13413	8681	1532
10 AM	11700	1376	8946	20646	10080	1072	6005	16085	10953	1933
11 AM	11262	1288	8059	19320	10457	1138	6610	17067	11787	2080
12 PM	10940	1226	7452	18392	11700	1376	8947	20646	14829	2617
1 PM	10918	1222	7411	18329	10402	1128	6520	16922	11664	2058
2 PM	10687	1179	7002	17689	11001	1238	7564	18565	13060	2305
3 PM	10598	1163	6848	17446	12782	1618	11492	24274	17913	3161
4 PM	10666	1175	6965	17631	12588	1572	10994	23582	17324	3057
5 PM	9379	958	4992	14371	10996	1237	7555	18550	13048	2303
6 PM	7167	651	2590	9758	8976	896	4469	13445	8708	1537.
7 PM	5173	427	1226	6399	6711	595	2220	8931	4872	860
8 PM	3807	296	625	4433	5723	484	1540	7263	3453	609
9 PM	2708	201	302	3010	4366	347	842	5208	1706	301
10 PM	2031	146	165	2196	2525	186	260	2785	0	0
11 PM	817	56	26	843	2303	168	215	2517	0	0

Base Q = queue formed after 30 minutes (gates closed to gates open)

added t = time for queue discharge wave to reach the back of the growing queue

added Q = additional queue length formed until the wave reaches the back

Total Q = Base Q + added Q

Q to S = westbound queue split extending to the southwest on SR-3

Q to N = westbound queue split extending to the northeast on SR-104

Note: a westbound Total Q under 3200 feet does not extend past the SR3/SR104 intersection

SR-104 Wednesday 90th Percentile Hourly Volumes

	Existi	ng Volum	es	EB Vehicles by Type			WB Vehicles by Type				
	EB	WB	Total	% Cars	% SU	% DU	% TU	% Cars	% SU	% DU	% TU
12 AM	26	83	109	0.79	0.07	0.14	0	0.94	0.02	0.04	0
1 AM	19	45	64	0.79	0.13	0.08	0	0.9	0.07	0.02	0.01
2 AM	24	32	56	0.66	0.06	0.21	0.07	0.83	0.07	0.09	0.01
3 AM	52	28	80	0.68	0.05	0.24	0.03	0.69	0.06	0.21	0.04
4 AM	148	44	192	0.85	0.07	0.07	0.01	0.67	0.18	0.13	0.02
5 AM	284	149	433	0.86	0.1	0.03	0.01	0.73	0.14	0.12	0.01
6 AM	434	297	731	0.86	0.09	0.04	0.01	0.73	0.14	0.09	0.04
7 AM	524	404	928	0.86	0.07	0.05	0.02	0.79	0.11	0.08	0.02
8 AM	563	439	1002	0.87	0.07	0.05	0.01	0.81	0.1	0.07	0.02
9 AM	639	480	1119	0.88	0.06	0.04	0.02	0.84	0.09	0.07	0
10 AM	670	560	1230	0.88	0.06	0.05	0.01	0.86	0.08	0.05	0.01
11 AM	642	616	1258	0.88	0.06	0.05	0.01	0.88	0.07	0.05	0
12 PM	613	638	1251	0.86	0.08	0.06	0	0.87	0.06	0.06	0.01
1 PM	640	639	1279	0.87	0.08	0.04	0.01	0.87	0.07	0.05	0.01
2 PM	636	665	1301	0.87	0.08	0.04	0.01	0.89	0.06	0.04	0.01
3 PM	634	761	1395	0.88	0.07	0.04	0.01	0.91	0.06	0.03	0
4 PM	640	778	1418	0.91	0.06	0.02	0.01	0.91	0.06	0.02	0.01
5 PM	581	678	1259	0.92	0.06	0.02	0	0.95	0.04	0.01	0
6 PM	475	579	1054	0.93	0.05	0.02	0	0.94	0.04	0.02	0
7 PM	339	438	777	0.94	0.03	0.03	0	0.94	0.04	0.02	0
8 PM	246	369	615	0.93	0.05	0.02	0	0.94	0.04	0.02	0
9 PM	175	289	464	0.93	0.05	0.02	0	0.91	0.06	0.03	0
10 PM	126	179	305	0.9	0.05	0.04	0.01	0.93	0.04	0.03	0
11 PM	48	144	192	0.84	0.07	0.09	0	0.92	0.04	0.03	0.01

Total 9178 9334 18512

SR-104 Wednesday Horizon Year 90th Percentile Hourly Volumes

	Exist	ing Volum	es	2021 Volumes			2031 Volumes		
	EB	WB	Total	EB	WB	Total	EB	WB	Total
12 AM	26	83	109	29	92	120	32	101	133
1 AM	19	45	64	21	50	71	23	55	78
2 AM	24	32	56	27	35	62	29	39	68
3 AM	52	28	80	57	31	88	63	34	98
4 AM	148	44	192	163	49	212	181	54	234
5 AM	284	149	433	314	165	478	347	182	528
6 AM	434	297	731	479	328	807	530	362	892
7 AM	524	404	928	579	446	1025	639	493	1132
8 AM	563	439	1002	622	485	1107	687	536	1223
9 AM	639	480	1119	706	530	1236	780	586	1365
10 AM	670	560	1230	740	619	1359	818	683	1501
11 AM	642	616	1258	709	680	1390	783	752	1535
12 PM	613	638	1251	677	705	1382	748	778	1526
1 PM	640	639	1279	707	706	1413	781	780	1561
2 PM	636	665	1301	703	735	1437	776	811	1587
3 PM	634	761	1395	700	841	1541	774	929	1702
4 PM	640	778	1418	707	859	1566	781	949	1730
5 PM	581	678	1259	642	749	1391	709	827	1536
6 PM	475	579	1054	525	640	1164	580	706	1286
7 PM	339	438	777	374	484	858	414	534	948
8 PM	246	369	615	272	408	679	300	450	750
9 PM	175	289	464	193	319	513	214	353	566
10 PM	126	179	305	139	198	337	154	218	372
11 PM	48	144	192	53	159	212	59	176	234
Total	9178	9334	18512	10138.2	10310.5	20449	11198.9	11389.3	22588

SR-104 Wednesday 2021 Horizon Year Queues

		2021 Eastbound				2021 We				
	Base Q	added t	added Q	Total Q	Base Q	added t	added Q	Total Q	Q to S	Q to N
12 AM	470	32	8	478	1247	87	60	1307	0	0
1 AM	327	22	4	331	695	48	18	713	0	0
2 AM	533	36	11	544	550	37	11	561	0	0
3 AM	1113	77	48	1161	592	40	13	605	0	0
4 AM	2469	181	248	2717	869	60	29	898	0	0
5 AM	4549	365	922	5470	2786	207	320	3106	0	0
6 AM	7011	631	2459	9471	5651	476	1496	7147	3355	592
7 AM	8668	851	4098	12766	7163	650	2586	9749	5566	982
8 AM	9111	917	4640	13751	7626	708	3001	10627	6313	1114
9 AM	10341	1117	6419	16759	7940	750	3308	11248	6841	1207
10 AM	10768	1194	7144	17912	9124	919	4657	13781	8994	1587
11 AM	10318	1113	6382	16701	9747	1017	5507	15255	10246	1808
12 PM	9920	1045	5762	15682	10413	1130	6537	16949	11687	2062
1 PM	10269	1105	6302	16571	10341	1117	6419	16759	11526	2034
2 PM	10204	1094	6200	16404	10523	1150	6720	17243	11936	2106
3 PM	10102	1076	6040	16142	11580	1352	8695	20275	14514	2561
4 PM	9809	1027	5597	15406	11924	1424	9431	21355	15432	2723
5 PM	8696	855	4132	12828	9830	1030	5627	15457	10419	1839
6 PM	7057	637	2497	9554	8538	832	3949	12487	7894	1393
7 PM	5046	414	1160	6206	6459	566	2031	8490	4497	794
8 PM	3655	282	572	4227	5442	454	1373	6815	3073	542
9 PM	2600	192	277	2877	4397	350	856	5253	1745	308
10 PM	1980	142	157	2137	2684	199	296	2980	0	0
11 PM	807	55	25	832	2211	161	197	2408	0	0

Base Q = queue formed after 30 minutes (gates closed to gates open)

added t = time for queue discharge wave to reach the back of the growing queue

added Q = additional queue length formed until the wave reaches the back

Total Q = Base Q + added Q

Q to S = westbound queue split extending to the southwest on SR-3

Q to N = westbound queue split extending to the northeast on SR-104

Note: a westbound Total Q under 3200 feet does not extend past the SR3/SR104 intersection

SR-104 Wednesday 2031 Horizon Year Queues

		2031 Eastbound				2031 We				
	Base Q	added t	added Q	Total Q	Base Q	added t	added Q	Total Q	Q to S	Q to N
12 AM	519	35	10	529	1377	97	74	1451	0	0
1 AM	362	24	5	367	767	53	22	790	0	0
2 AM	589	40	13	602	607	41	14	621	0	0
3 AM	1229	86	59	1288	653	45	16	670	0	0
4 AM	2727	202	306	3033	960	66	35	995	0	0
5 AM	5025	412	1149	6174	3077	232	396	3473	232	41
6 AM	7745	724	3115	10860	6242	541	1877	8119	4182	738
7 AM	9575	989	5261	14836	7912	746	3279	11191	6793	1199
8 AM	10064	1070	5981	16045	8423	816	3819	12243	7686	1356
9 AM	11423	1320	8376	19799	8771	866	4220	12991	8322	1469
10 AM	11895	1417	9367	21262	10079	1072	6003	16082	10950	1932
11 AM	11398	1315	8327	19725	10767	1194	7142	17909	12503	2206
12 PM	10958	1230	7485	18443	11502	1336	8536	20039	14313	2526
1 PM	11343	1304	8217	19560	11423	1320	8376	19799	14109	2490
2 PM	11272	1290	8078	19350	11624	1361	8787	20411	14629	2582
3 PM	11159	1268	7861	19020	12791	1620	11514	24305	17940	3166
4 PM	10835	1207	7263	18098	13172	1715	12546	25718	19140	3378
5 PM	9606	994	5305	14911	10858	1211	7304	18162	12718	2244
6 PM	7795	731	3164	10960	9432	966	5063	14495	9601	1694
7 PM	5574	468	1450	7024	7135	646	2563	9697	5523	975
8 PM	4037	316	710	4747	6011	515	1721	7732	3852	680
9 PM	2872	214	342	3214	4858	395	1066	5923	2315	408
10 PM	2187	159	193	2380	2965	222	366	3331	111	20
11 PM	892	61	30	922	2442	179	243	2685	0	0

Base Q = queue formed after 30 minutes (gates closed to gates open)

added t = time for queue discharge wave to reach the back of the growing queue

added Q = additional queue length formed until the wave reaches the back

Total Q = Base Q + added Q

Q to S = westbound queue split extending to the southwest on SR-3

Q to N = westbound queue split extending to the northeast on SR-104

Note: a westbound Total Q under 3200 feet does not extend past the SR3/SR104 intersection

SR-104 Thursday 90th Percentile Hourly Volumes

	Existi	ng Volum	es 🛛	EB Vehicles by Type			WB Vehicles by Type				
	EB	WB	Total	% Cars	% SU	% DU	% TU	% Cars	% SU	% DU	% TU
12 AM	26	92	118	0.75	0.07	0.16	0.02	0.89	0.03	0.07	0.01
1 AM	21	49	70	0.63	0.13	0.21	0.03	0.87	0.05	0.08	0
2 AM	25	34	59	0.61	0.07	0.27	0.05	0.7	0.08	0.19	0.03
3 AM	51	28	79	0.62	0.1	0.2	0.08	0.66	0.13	0.19	0.02
4 AM	144	48	192	0.79	0.1	0.09	0.02	0.65	0.16	0.16	0.03
5 AM	272	147	419	0.85	0.09	0.04	0.02	0.73	0.12	0.12	0.03
6 AM	426	295	721	0.87	0.08	0.04	0.01	0.79	0.1	0.09	0.02
7 AM	524	404	928	0.88	0.07	0.05	0	0.77	0.11	0.1	0.02
8 AM	577	455	1032	0.86	0.07	0.05	0.02	0.79	0.12	0.07	0.02
9 AM	652	504	1156	0.85	0.08	0.06	0.01	0.84	0.09	0.06	0.01
10 AM	691	615	1306	0.86	0.08	0.05	0.01	0.86	0.08	0.06	0
11 AM	670	660	1330	0.87	0.07	0.05	0.01	0.87	0.07	0.05	0.01
12 PM	654	669	1323	0.86	0.08	0.05	0.01	0.86	0.07	0.06	0.01
1 PM	649	667	1316	0.88	0.07	0.04	0.01	0.9	0.06	0.04	0
2 PM	662	721	1383	0.87	0.07	0.04	0.02	0.89	0.07	0.04	0
3 PM	659	799	1458	0.88	0.08	0.04	0	0.91	0.07	0.02	0
4 PM	668	788	1456	0.9	0.07	0.02	0.01	0.92	0.05	0.02	0.01
5 PM	616	712	1328	0.92	0.05	0.02	0.01	0.92	0.05	0.02	0.01
6 PM	497	618	1115	0.93	0.05	0.02	0	0.94	0.05	0.01	0
7 PM	369	499	868	0.92	0.05	0.02	0.01	0.92	0.06	0.02	0
8 PM	274	454	728	0.94	0.03	0.02	0.01	0.93	0.05	0.02	0
9 PM	190	361	551	0.94	0.04	0.02	0	0.94	0.04	0.02	0
10 PM	135	206	341	0.93	0.04	0.03	0	0.95	0.03	0.02	0
11 PM	54	158	212	0.82	0.1	0.06	0.02	0.94	0.03	0.03	0

Total 9506 9983 19489

SR-104 Thursday Horizon Year 90th Percentile Hourly Volumes

	Existing Volumes			202	1 Volume	es	2031 Volumes		
	EB	WB	Total	EB	WB	Total	EB	WB	Total
12 AM	26	92	118	29	102	130	32	112	144
1 AM	21	49	70	23	54	77	26	60	85
2 AM	25	34	59	28	38	65	31	41	72
3 AM	51	28	79	56	31	87	62	34	96
4 AM	144	48	192	159	53	212	176	59	234
5 AM	272	147	419	300	162	463	332	179	511
6 AM	426	295	721	471	326	796	520	360	880
7 AM	524	404	928	579	446	1025	639	493	1132
8 AM	577	455	1032	637	503	1140	704	555	1259
9 AM	652	504	1156	720	557	1277	796	615	1411
10 AM	691	615	1306	763	679	1443	843	750	1594
11 AM	670	660	1330	740	729	1469	818	805	1623
12 PM	654	669	1323	722	739	1461	798	816	1614
1 PM	649	667	1316	717	737	1454	792	814	1606
2 PM	662	721	1383	731	796	1528	808	880	1688
3 PM	659	799	1458	728	883	1611	804	975	1779
4 PM	668	788	1456	738	870	1608	815	962	1777
5 PM	616	712	1328	680	786	1467	752	869	1620
6 PM	497	618	1115	549	683	1232	606	754	1361
7 PM	369	499	868	408	551	959	450	609	1059
8 PM	274	454	728	303	501	804	334	554	888
9 PM	190	361	551	210	399	609	232	440	672
10 PM	135	206	341	149	228	377	165	251	416
11 PM	54	158	212	60	175	234	66	193	259
Total	9506	9983	19489	10501	11027	21528	11599	12181	23780

SR-104 Thursday 2021 Horizon Year Queues

		2021 Eastbound				2021 We				
	Base Q	added t	added Q	Total Q	Base Q	added t	added Q	Total Q	Q to S	Q to N
12 AM	501	34	9	511	1494	105	87	1581	0	0
1 AM	452	31	8	460	801	55	24	826	0	0
2 AM	577	39	13	590	697	48	18	715	0	0
3 AM	1161	81	52	1213	579	39	13	592	0	0
4 AM	2573	190	271	2844	990	69	38	1028	0	0
5 AM	4492	359	896	5388	2821	210	329	3151	0	0
6 AM	6835	610	2317	9152	5271	437	1279	6549	2847	502
7 AM	8292	798	3675	11967	7363	675	2761	10125	5886	1039
8 AM	9545	984	5219	14764	8004	758	3372	11376	6950	1226
9 AM	10785	1197	7174	17959	8393	812	3785	12178	7631	1347
10 AM	11259	1287	8052	19311	9952	1051	5810	15763	10678	1884
11 AM	10842	1208	7276	18118	10681	1178	6990	17671	12300	2171
12 PM	10656	1174	694 7	17603	10993	1236	7549	18541	13040	2301
1 PM	10341	1117	6420	16761	10315	1113	6377	16692	11468	2024
2 PM	10786	1197	7175	17961	11230	1282	7996	19226	13622	2404
3 PM	10337	1117	6412	16749	12047	1450	9707	21754	15771	2783
4 PM	10312	1112	6372	16684	11990	1438	9578	21569	15613	2755
5 PM	9373	957	4984	14357	10834	1206	7260	18094	12660	2234
6 PM	7384	678	2780	10164	9028	904	4535	13563	8809	1555
7 PM	5615	473	1474	7089	7469	688	2856	10325	6056	1069
8 PM	4109	323	737	4846	6745	599	2246	8991	4923	869
9 PM	2802	208	324	3126	5324	442	1307	6631	2916	515
10 PM	2024	146	164	2188	3015	226	379	3394	165	29
11 PM	925	64	33	957	2352	172	224	2576	0	0

Base Q = queue formed after 30 minutes (gates closed to gates open)

added t = time for queue discharge wave to reach the back of the growing queue

added Q = additional queue length formed until the wave reaches the back

Total Q = Base Q + added Q

Q to S = westbound queue split extending to the southwest on SR-3

Q to N = westbound queue split extending to the northeast on SR-104

Note: a westbound Total Q under 3200 feet does not extend past the SR3/SR104 intersection

SR-104 Thursday 2031 Horizon Year Queues

		2031 Eastbound				2031 We				
	Base Q	added t	added Q	Total Q	Base Q	added t	added Q	Total Q	Q to S	Q to N
12 AM	554	38	12	565	1650	117	107	1758	0	0
1 AM	500	34	9	509	885	61	30	915	0	0
2 AM	638	44	15	653	770	53	23	792	0	0
3 AM	1282	90	64	1346	640	44	16	655	0	0
4 AM	2842	212	334	3176	1094	76	46	1140	0	0
5 AM	4962	405	1117	6079	3117	235	407	3523	275	48
6 AM	7550	699	2931	10481	5822	495	1601	7423	3590	633
7 AM	9159	924	4702	13861	8134	776	3507	11641	7174	1266
8 AM	10543	1153	6755	17298	8841	876	4305	13146	8454	1492
9 AM	11914	1421	9408	21322	9271	941	4848	14119	9281	1638
10 AM	12436	1537	10620	23057	10994	1236	7551	18544	13043	2302
11 AM	11977	1435	9548	21525	11798	1397	9156	20954	15091	2663
12 PM	11771	1391	9097	20868	12143	1471	9924	22066	16036	2830
1 PM	11423	1320	8377	19800	11394	1314	8319	19713	14036	2477
2 PM	11915	1422	9410	21325	12405	1530	10543	22947	16785	2962
3 PM	11418	1319	8367	19786	13308	1749	12934	26242	19586	3456
4 PM	11391	1314	8313	19703	13245	1733	12753	25998	19378	3420
5 PM	10354	1120	6440	16794	11967	1433	9527	21495	15550	2744
6 PM	8157	779	3531	11687	9973	1054	5841	15814	10722	1892
7 PM	6202	537	1850	8052	8250	792	3630	11881	7378	1302
8 PM	4539	364	917	5456	7451	686	2840	10291	6027	1064
9 PM	3095	233	401	3496	5881	501	1637	7518	3670	648
10 PM	2236	163	202	2438	3331	253	469	3799	509	90
11 PM	1021	71	40	1061	2598	192	277	2874	0	0

Base Q = queue formed after 30 minutes (gates closed to gates open)

added t = time for queue discharge wave to reach the back of the growing queue

added Q = additional queue length formed until the wave reaches the back

Total Q = Base Q + added Q

Q to S = westbound queue split extending to the southwest on SR-3

Q to N = westbound queue split extending to the northeast on SR-104

Note: a westbound Total Q under 3200 feet does not extend past the SR3/SR104 intersection

SR-104 Friday 90th Percentile Hourly Volumes

	Existi	ng Volum	es	EB Vehicles by Type				WB Vehicles by Type			
	EB	WB	Total	% Cars	% SU	% DU	% TU	% Cars	% SU	% DU	% TU
12 AM	32	94	126	0.82	0.08	0.1	0	0.9	0.04	0.05	0.01
1 AM	21	50	71	0.7	0.14	0.16	0	0.84	0.05	0.11	0
2 AM	26	39	65	0.64	0.14	0.21	0.01	0.75	0.11	0.11	0.03
3 AM	51	31	82	0.7	0.07	0.21	0.02	0.74	0.07	0.18	0.01
4 AM	135	47	182	0.77	0.1	0.11	0.02	0.62	0.16	0.21	0.01
5 AM	246	144	390	0.87	0.08	0.05	0	0.79	0.06	0.13	0.02
6 AM	395	277	672	0.87	0.08	0.04	0.01	0.81	0.09	0.08	0.02
7 AM	477	394	871	0.88	0.06	0.05	0.01	0.81	0.09	0.09	0.01
8 AM	542	447	989	0.88	0.07	0.04	0.01	0.87	0.08	0.04	0.01
9 AM	640	535	1175	0.89	0.06	0.05	0	0.9	0.06	0.04	0
10 AM	712	671	1383	0.87	0.07	0.05	0.01	0.91	0.05	0.03	0.01
11 AM	710	764	1474	0.88	0.06	0.06	0	0.92	0.05	0.03	0
12 PM	700	787	1487	0.89	0.06	0.04	0.01	0.92	0.04	0.03	0.01
1 PM	712	827	1539	0.89	0.07	0.04	0	0.92	0.05	0.03	0
2 PM	737	915	1652	0.89	0.07	0.04	0	0.92	0.05	0.03	0
3 PM	721	940	1661	0.91	0.06	0.03	0	0.93	0.05	0.02	0
4 PM	709	989	1698	0.93	0.05	0.02	0	0.94	0.05	0.01	0
5 PM	687	918	1605	0.95	0.04	0.01	0	0.94	0.04	0.02	0
6 PM	594	798	1392	0.94	0.04	0.02	0	0.94	0.05	0.01	0
7 PM	428	712	1140	0.94	0.04	0.02	0	0.94	0.05	0.01	0
8 PM	311	603	914	0.94	0.04	0.01	0.01	0.95	0.04	0.01	0
9 PM	230	493	723	0.95	0.03	0.02	0	0.95	0.03	0.02	0
10 PM	182	311	493	0.95	0.04	0.01	0	0.94	0.04	0.02	0
11 PM	81	223	304	0.93	0.03	0.04	0	0.95	0.03	0.02	0

Total	10079	12009	22088

SR-104 Friday Horizon Year 90th Percentile Hourly Volumes

	Exist	Existing Volumes			1 Volume	s	2031 Volumes		
	EB	WB	Total	EB	WB	Total	EB	WB	Total
12 AM	32	94	126	35	104	139	39	115	154
1 AM	21	50	71	23	55	78	26	61	87
2 AM	26	39	65	29	43	- 72	32	48	79
3 AM	51	31	82	56	34	91	62	38	100
4 AM	135	47	182	149	52	201	165	57	222
5 AM	246	144	390	272	159	431	300	176	476
6 AM	395	277	672	436	306	742	482	338	820
7 AM	477	394	871	527	435	962	582	481	1063
8 AM	542	447	989	599	494	1092	661	545	1207
9 AM	640	535	1175	707	591	1298	781	653	1434
10 AM	712	671	1383	786	741	1528	869	819	1688
11 AM	710	764	1474	784	844	1628	866	932	1799
12 PM	700	787	1487	773	869	1643	854	960	1814
1 PM	712	827	1539	786	914	1700	869	1009	1878
2 PM	737	915	1652	814	1011	1825	899	1116	2016
3 PM	721	940	1661	796	1038	1835	880	1147	2027
4 PM	709	989	1698	783	1092	1876	865	1207	2072
5 PM	687	918	1605	759	1014	1773	838	1120	1958
6 PM	594	798	1392	656	881	1538	725	974	1699
7 PM	428	712	1140	473	786	1259	522	869	1391
8 PM	311	603	914	344	666	1010	379	736	1115
9 PM	230	493	723	254	545	799	281	602	882
10 PM	182	311	493	201	344	545	222	379	602
11 PM	81	223	304	89	246	336	99	272	371
Total	10079	12009	22088	11133	13265	24399	12298	14653	26952

SR-104 Friday 2021 Horizon Year Queues

		2021 Eas	tbound		2021 Westbound					
	Base Q	added t	added Q	Total Q	Base Q	added t	added Q	Total Q	Q to S	Q to N
12 AM	550	37	11	561	1490	105	87	1577	0	0
1 AM	406	27	6	412	855	59	28	883	0	0
2 AM	544	37	11	555	735	50	21	755	0	0
3 AM	1046	73	42	1089	602	41	14	616	0	0
4 AM	2479	182	251	2730	994	69	38	1032	0	0
5 AM	3920	306	666	4586	2652	196	289	2941	0	0
6 AM	6338	552	1944	8282	4850	394	1062	5912	2305	407
7 AM	7666	714	3040	10707	6855	612	2332	9187	5089	898
8 AM	8636	847	4062	12698	7172	651	2594	9766	5581	985
9 AM	10056	1068	5969	16025	8274	795	3655	11929	7420	1309
10 AM	11522	1340	8577	20099	10377	1124	6478	16854	11606	2048
11 AM	11333	1302	8198	19531	11541	1344	8616	20156	14413	2543
12 PM	11077	1252	7705	18782	12084	1458	9789	21873	15872	2801
1 PM	11090	1255	7729	18819	12492	1550	10757	23250	17042	3007
2 PM	11479	1331	8489	19968	13822	1888	14497	28318	21351	3768
3 PM	10971	1232	7509	18480	13966	1929	14964	28930	21870	3859
4 PM	10534	1151	6739	17272	14448	2072	16630	31078	23696	4182
5 PM	9960	1052	5822	15782	13537	1810	13613	27150	20358	3593
6 PM	8760	864	4207	12966	11658	1368	8858	20516	14718	2597
7 PM	6312	549	1926	8237	10401	1128	6518	16919	11661	2058
8 PM	4621	372	954	5575	8742	862	4186	12929	8269	1459
9 PM	3366	256	479	3846	7216	656	2632	9847	5650	997
10 PM	2639	195	286	2924	4586	368	938	5525	1976	349
11 PM	1226	86	58	1284	3264	248	449	3713	436	77

Base Q = queue formed after 30 minutes (gates closed to gates open)

added t = time for queue discharge wave to reach the back of the growing queue

added Q = additional queue length formed until the wave reaches the back

Total Q = Base Q + added Q

Q to S = westbound queue split extending to the southwest on SR-3

Q to N = westbound queue split extending to the northeast on SR-104

Note: a westbound Total Q under 3200 feet does not extend past the SR3/SR104 intersection

SR-104 Friday 2031 Horizon Year Queues

		2031 East	tbound		2031 Westbound					
	Base Q	added t	added Q	Total Q	Base Q	added t	added Q	Total Q	Q to S	Q to N
12 AM	607	41	14	621	1646	117	107	1753	0	0
1 AM	448	30	8	456	944	65	34	978	0	0
2 AM	601	41	14	615	811	56	25	837	0	0
3 AM	1156	81	52	1208	665	45	17	682	0	0
4 AM	2739	203	309	3048	1098	76	47	1145	0	0
5 AM	4330	344	827	5157	2930	219	357	3287	74	13
6 AM	7001	630	2451	9451	5357	446	1326	6683	2961	522
7 AM	8469	823	3870	12339	7572	702	2951	10523	6225	1098
8 AM	9540	983	5212	14752	7922	747	3290	11212	6810	1202
9 AM	11109	1258	7765	18874	9139	921	4676	13816	9023	1592
10 AM	12728	1605	11350	24077	11462	1328	8456	19919	14211	2508
11 AM	12519	1556	10822	23340	12748	1610	11403	24151	17809	3143
12 PM	12235	1492	10140	22375	13348	1760	13051	26399	19719	3480
1 PM	12250	1495	10173	22423	13799	1882	14425	28225	21271	3754
2 PM	12680	1594	11227	23907	15268	2342	19869	35137	27146	4790
3 PM	12119	1466	9869	21988	15427	2399	20564	35991	27872	4919
4 PM	11636	1363	8812	20448	15960	2602	23070	39030	30455	5374
5 PM	11002	1238	7567	18569	14954	2234	18563	33517	25769	4548
6 PM	9676	1005	5404	15080	12877	1641	11742	24619	18206	3213
7 PM	6972	627	2427	9399	11490	1333	8511	20001	14280	2520
8 PM	5104	420	1190	6294	9657	1002	5377	15034	10059	1775
9 PM	3719	287	594	4312	7971	754	3339	11309	6893	1216
10 PM	2915	218	353	3267	5066	416	1170	6236	2581	455
11 PM	1354	95	71	1426	3605	277	556	4161	817	144

Base Q = queue formed after 30 minutes (gates closed to gates open)

added t = time for queue discharge wave to reach the back of the growing queue

added Q = additional queue length formed until the wave reaches the back

Total Q = Base Q + added Q

Q to S = westbound queue split extending to the southwest on SR-3

Q to N = westbound queue split extending to the northeast on SR-104

Note: a westbound Total Q under 3200 feet does not extend past the SR3/SR104 intersection

SR-104 Saturday 90th Percentile Hourly Volumes

	Existi	ng Volum	es		EB Vehicle	es by Type		WB Vehicles by Type			e
	EB	WB	Total	% Cars	% SU	% DU	% TU	% Cars	% SU	% DU	% TU
12 AM	40	135	175	0.89	0.03	0.08	0	0.91	0.04	0.05	0
1 AM	26	86	112	0.85	0.08	0.07	0	0.95	0.03	0.02	0
2 AM	26	48	74	0.75	0.09	0.14	0.02	0.85	0.08	0.07	0
3 AM	28	34	62	0.75	0.07	0.15	0.03	0.82	0.06	0.12	0
4 AM	59	44	103	0.88	0.1	0.02	0	0.8	0.05	0.15	0
5 AM	98	89	187	0.89	0.08	0.03	0	0.85	0.06	0.09	0
6 AM	190	209	399	0.91	0.06	0.02	0.01	0.9	0.06	0.04	0
7 AM	333	356	689	0.9	0.07	0.03	0	0.91	0.05	0.03	0.01
8 AM	488	497	985	0.92	0.06	0.02	0	0.94	0.04	0.02	0
9 AM	677	679	1356	0.93	0.05	0.02	0	0.96	0.03	0.01	0
10 AM	741	870	1611	0.92	0.06	0.02	0	0.96	0.03	0.01	0
11 AM	766	995	1761	0.93	0.05	0.02	0	0.96	0.03	0.01	0
12 PM	703	938	1641	0.93	0.05	0.02	0	0.96	0.03	0.01	0
1 PM	696	937	1633	0.93	0.05	0.02	0	0.96	0.03	0.01	0
2 PM	708	870	1578	0.94	0.04	0.02	0	0.96	0.03	0.01	0
3 PM	736	845	1581	0.95	0.04	0.01	0	0.95	0.04	0.01	0
4 PM	813	773	1586	0.97	0.03	0	0	0.95	0.04	0.01	0
5 PM	795	658	1453	0.97	0.03	0	0	0.95	0.04	0.01	0
6 PM	705	592	1297	0.96	0.03	0.01	0	0.95	0.04	0.01	0
7 PM	589	489	1078	0.97	0.03	0	0	0.95	0.04	0.01	0
8 PM	499	418	917	0.98	0.02	0	0	0.96	0.03	0.01	0
9 PM	382	342	724	0.97	0.03	0	0	0.96	0.04	0	0
10 PM	280	274	554	0.97	0.02	0.01	0	0.96	0.03	0.01	0
11 PM	129	183	312	0.97	0.03	0	0	0.95	0.03	0.02	0

Total	10507	11361	21868
Total	10201	TT201	21000

SR-104 Saturday Horizon Year 90th Percentile Hourly Volumes

	Exist	ing Volum	es	202	21 Volume	es	2031 Volumes		
	EB	WB	Total	EB	WB	Total	EB	WB	Total
12 AM	40	135	175	44	149	193	49	165	214
1 AM	26	86	112	29	95	124	32	105	137
2 AM	26	48	74	29	53	82	32	59	90
3 AM	28	34	62	31	38	68	34	41	76
4 AM	59	44	103	65	49	114	72	54	126
5 AM	98	89	187	108	98	207	120	109	228
6 AM	190	209	399	210	231	441	232	255	487
7 AM	333	356	689	368	393	761	406	434	841
8 AM	488	497	985	539	549	1088	595	606	1202
9 AM	677	679	1356	748	750	1498	826	829	1655
10 AM	741	870	1611	819	961	1780	904	1062	1966
11 AM	766	995	1761	846	1099	1945	935	1214	2149
12 PM	703	938	1641	777	1036	1813	858	1145	2002
1 PM	696	937	1633	769	1035	1804	849	1143	1993
2 PM	708	870	1578	782	961	1743	864	1062	1925
3 PM	736	845	1581	813	933	1746	898	1031	1929
4 PM	813	773	1586	898	854	1752	992	943	1935
5 PM	795	658	1453	878	727	1605	970	803	1773
6 PM	705	592	1297	779	654	1433	860	722	1583
7 PM	589	489	1078	651	540	1191	719	597	1315
8 PM	499	418	917	551	462	1013	609	510	1119
9 PM	382	342	724	422	378	800	466	417	883
10 PM	280	274	554	309	303	612	342	334	676
11 PM	129	183	312	142	202	345	157	223	381
	-		•						
Total	10507	11361	21868	11606	12550	24156	12821	13863	26683

SR-104 Saturday 2021 Horizon Year Queues

		2021 East	tbound		2021 Westbound					
	Base Q	added t	added Q	Total Q	Base Q	added t	added Q	Total Q	Q to S	Q to N
12 AM	645	44	16	661	2091	151	176	2267	0	0
1 AM	427	29	7	434	1259	88	62	1320	0	0
2 AM	494	34	9	503	789	54	24	812	0	0
3 AM	543	37	11	554	593	40	13	607	0	0
4 AM	909	63	32	941	796	55	24	820	0	0
5 AM	1513	107	90	1603	1487	105	87	1574	0	0
6 AM	2912	218	352	3264	3232	245	440	3672	401	71
7 AM	5104	420	1190	6293	5505	461	1410	6916	3158	557
8 AM	7304	668	2709	10013	7329	671	2731	10060	5831	1029
9 AM	10058	1069	5972	16030	9769	1021	5539	15308	10292	1816
10 AM	11091	1255	7732	18823	12517	1556	10819	23336	17116	3020
11 AM	11381	1312	8292	19673	14316	2032	16157	30473	23182	4091
12 PM	10445	1136	6589	17034	13496	1799	13487	26983	20215	3567
1 PM	10341	1117	6418	16759	13481	1795	13444	26925	20166	3559
2 PM	10441	1135	6583	17024	12517	1556	10819	23336	17116	3020
3 PM	10671	1176	6973	17644	12251	1495	10176	22427	16343	2884
4 PM	11495	1335	8522	20018	11207	1277	7953	19160	13566	2394
5 PM	11241	1284	8018	19258	9540	983	5212	14752	9819	1733
6 PM	10143	1083	6104	16247	8583	839	4000	12583	7975	1407
7 PM	8328	803	3714	12042	7090	641	2524	9614	5452	962
8 PM	7000	630	2450	9451	6014	516	1723	7738	3857	681
9 PM	5401	450	1351	6752	4873	396	1073	5947	2335	412
10 PM	3998	313	695	4692	3942	308	674	4616	1204	212
11 PM	1824	130	132	1956	2678	198	295	2973	0	0

Base Q = queue formed after 30 minutes (gates closed to gates open)

added t = time for queue discharge wave to reach the back of the growing queue

added Q = additional queue length formed until the wave reaches the back

Total Q = Base Q + added Q

Q to S = westbound queue split extending to the southwest on SR-3

Q to N = westbound queue split extending to the northeast on SR-104

Note: a westbound Total Q under 3200 feet does not extend past the SR3/SR104 intersection

SR-104 Saturday 2031 Horizon Year Queues

		2031 East	tbound			2031 We	stbound			
	Base Q	added t	added Q	Total Q	Base Q	added t	added Q	Total Q	Q to S	Q to N
12 AM	713	49	19	732	2310	168	216	2526	0	0
1 AM	472	32	8	480	1390	98	75	1466	0	0
2 AM	546	37	11	557	871	60	29	900	0	0
3 AM	600	41	14	613	655	45	16	672	0	0
4 AM	1004	70	39	1043	879	61	30	909	0	0
5 AM	1671	119	110	1781	1643	117	106	1749	0	0
6 AM	3217	243	435	3652	3570	274	544	4114	777	137
7 AM	5638	475	1488	7126	6081	523	1768	7849	3952	697
8 AM	8068	767	3439	11507	8096	771	3467	11563	7109	1254
9 AM	11111	1259	7769	18880	10791	1198	7185	17976	12560	2216
10 AM	12251	1495	10177	22428	13827	1889	14513	28340	21369	3771
11 AM	12571	1568	10953	23524	15814	2545	22354	38168	29723	5245
12 PM	11537	1343	8608	20146	14908	2219	18378	33286	25573	4513
1 PM	11422	1320	8376	19798	14892	2214	18315	33207	25506	4501
2 PM	11533	1342	8600	20133	13827	1889	14513	28340	21369	3771
3 PM	11787	1395	9133	20920	13533	1809	13598	27131	20341	3590
4 PM	12698	1598	11273	23971	12380	1524	10482	22862	16713	2949
5 PM	12417	1533	10572	22989	10538	1152	6746	17283	11971	2113
6 PM	11205	1277	7948	19153	9481	974	5131	14612	9700	1712
7 PM	9199	930	4754	13953	7831	735	3199	11031	6656	1175
8 PM	7733	722	3103	10836	6643	587	2168	8811	4770	842
9 PM	5966	511	1692	7659	5383	448	1341	6724	2995	529
10 PM	4416	352	863	5279	4355	346	837	5192	1693	299
11 PM	2015	145	162	2177	2959	222	364	3323	104	18

Base Q = queue formed after 30 minutes (gates closed to gates open)

added t = time for queue discharge wave to reach the back of the growing queue

added Q = additional queue length formed until the wave reaches the back

Total Q = Base Q + added Q

Q to S = westbound queue split extending to the southwest on SR-3

Q to N = westbound queue split extending to the northeast on SR-104

Note: a westbound Total Q under 3200 feet does not extend past the SR3/SR104 intersection

SR-104 Sunday 90th Percentile Hourly Volumes

	Existi	ng Volum	es		EB Vehicle	es by Type		WB Vehicles by Type			e
	EB	WB	Total	% Cars	% SU	% DU	% TU	% Cars	% SU	% DU	% TU
12 AM	54	131	185	0.9	0.06	0.04	0	0.94	0.04	0.02	0
1 AM	30	72	102	0.9	0.05	0.04	0.01	0.94	0.04	0.02	0
2 AM	22	40	62	0.87	0.06	0.06	0.01	0.92	0.05	0.03	0
3 AM	23	29	52	0.88	0.07	0.05	0	0.91	0.06	0.03	0
4 AM	41	29	70	0.95	0.03	0.02	0	0.91	0.03	0.06	0
5 AM	68	55	123	0.91	0.07	0.02	0	0.88	0.04	0.08	0
6 AM	113	102	215	0.94	0.03	0.03	0	0.93	0.03	0.03	0.01
7 AM	231	201	432	0.93	0.05	0.01	0.01	0.92	0.06	0.01	0.01
8 AM	384	242	626	0.95	0.04	0.01	0	0.94	0.04	0.02	0
9 AM	619	465	1084	0.95	0.04	0.01	0	0.96	0.03	0.01	0
10 AM	803	625	1428	0.95	0.03	0.01	0.01	0.96	0.03	0.01	0
11 AM	911	748	1659	0.95	0.04	0.01	0	0.96	0.03	0.01	0
12 PM	908	782	1690	0.94	0.04	0.02	0	0.96	0.03	0.01	0
1 PM	961	759	1720	0.94	0.04	0.02	0	0.96	0.03	0.01	0
2 PM	961	719	1680	0.96	0.03	0.01	0	0.95	0.04	0.01	0
3 PM	971	712	1683	0.96	0.03	0.01	0	0.96	0.03	0.01	0
4 PM	1011	690	1701	0.97	0.03	0	0	0.95	0.04	0.01	0
5 PM	961	620	1581	0.98	0.02	0	0	0.95	0.04	0.01	0
6 PM	825	630	1455	0.97	0.03	0	0	0.95	0.04	0.01	0
7 PM	666	507	1173	0.97	0.02	0.01	0	0.95	0.04	0.01	0
8 PM	503	402	905	0.96	0.03	0.01	0	0.95	0.04	0.01	0
9 PM	332	305	637	0.96	0.03	0.01	0	0.95	0.04	0.01	0
10 PM	217	204	421	0.95	0.03	0.02	0	0.95	0.04	0.01	0
11 PM	77	117	194	0.91	0.04	0.04	0.01	0.93	0.02	0.05	0

Total	11692	9186	20878
TOtal	11002	2100	20070

SR-104 Sunday Horizon Year 90th Percentile Hourly Volumes

	Existi	ng Volum	es	202	1 Volume	s	2031 Volumes		
	EB	WB	Total	EB	WB	Total	EB	WB	Total
12 AM	54	131	185	60	145	204	66	160	226
1 AM	30	72	102	33	80	113	37	88	124
2 AM	22	40	62	24	44	68	27	49	76
3 AM	23	29	52	25	32	57	28	35	63
4 AM	41	29	70	45	32	77	50	35	85
5 AM	68	55	123	75	61	136	83	67	150
6 AM	113	102	215	125	113	237	138	124	262
7 AM	231	201	432	255	222	477	282	245	527
8 AM	384	242	626	424	267	691	469	295	764
9 AM	619	465	1084	684	514	1197	755	567	1323
10 AM	803	625	1428	887	690	1577	980	763	1742
11 AM	911	748	1659	1006	826	1833	1112	913	2024
12 PM	908	782	1690	1003	864	1867	1108	954	2062
1 PM	961	759	1720	1062	838	1900	1173	926	2099
2 PM	961	719	1680	1062	794	1856	1173	877	2050
3 PM	971	712	1683	1073	786	1859	1185	869	2054
4 PM	1011	690	1701	1117	762	1879	1234	842	2076
5 PM	961	620	1581	1062	685	1746	1173	757	1929
6 PM	825	630	1455	911	696	1607	1007	769	1775
7 PM	666	507	1173	736	560	1296	813	619	1431
8 PM	503	402	905	556	444	1000	614	491	1104
9 PM	332	305	637	367	337	704	405	372	777
10 PM	217	204	421	240	225	465	265	249	514
11 PM	77	117	194	85	129	214	94	143	237
Total	11692	9186	20878	12915	10147	23062	14266	11209	25475

SR-104 Sunday 2021 Horizon Year Queues

		2021 East	tbound		2021 Westbound					
	Base Q	added t	added Q	Total Q	Base Q	added t	added Q	Total Q	Q to S	Q to N
12 AM	835	57	27	862	1932	139	149	2081	0	0
1 AM	471	32	8	480	1062	74	43	1105	0	0
2 AM	359	24	5	364	604	41	14	618	0	0
3 AM	364	25	5	369	441	30	7	449	0	0
4 AM	600	41	14	614	453	31	8	461	0	0
5 AM	1025	71	40	1066	893	62	31	924	0	0
6 AM	1682	120	112	1794	1555	110	95	1650	0	0
7 AM	3458	264	508	3965	3031	228	383	3414	182	32
8 AM	5567	468	1446	7013	3569	274	544	4112	775	137
9 AM	8974	896	4468	13442	6690	593	2204	8894	4840	854
10 AM	11842	1406	9251	21092	8992	899	4490	13483	8740	1542
11 AM	13208	1724	12648	25856	10762	1193	7133	17895	12490	2204
12 PM	13390	1771	13174	26564	11251	1286	8038	19289	13676	2413
1 PM	14172	1988	15655	29827	10920	1222	7416	18337	12866	2270
2 PM	13827	1889	14512	28339	10424	1132	6556	16980	11713	2067
3 PM	13970	1930	14979	28950	10244	1100	6263	16507	11311	1996
4 PM	14295	2025	16083	30378	10004	1059	5888	1589 2	10788	1904
5 PM	13482	1795	13445	26926	8989	898	4486	13475	8734	1541
6 PM	11665	1369	8873	20538	9134	920	4670	13803	9013	1591
7 PM	9509	979	5169	14678	7351	673	2750	10100	5865	1035
8 PM	7237	659	2650	9887	5828	496	1604	7433	3598	635
9 PM	4777	387	1027	5803	4422	353	866	5288	1775	313
10 PM	3176	240	423	3599	2958	221	364	3321	103	18
11 PM	1201	84	56	1257	1787	128	127	1913	0	0

Base Q = queue formed after 30 minutes (gates closed to gates open)

added t = time for queue discharge wave to reach the back of the growing queue

added Q = additional queue length formed until the wave reaches the back

Total Q = Base Q + added Q

Q to S = westbound queue split extending to the southwest on SR-3

Q to N = westbound queue split extending to the northeast on SR-104

Note: a westbound Total Q under 3200 feet does not extend past the SR3/SR104 intersection

SR-104 Sunday 2031 Horizon Year Queues

		2031 East	tbound			2031 We					
	Base Q added t		added Q	Total Q	Base Q	added t	added Q	Total Q	Q to S	Q to N	
12 AM	922	64	33	955	2134	154	183	2317	0	0	
1 AM	521	35	10	531	1173	82	53	1226	0	0	
2 AM	397	27	6	403	667	46	17	684	0	0	
3 AM	402	27	6	408	487	33	9	496	0	0	
4 AM	663	45	17	680	501	34	9	510	0	0	
5 AM	1133	79	50	1182	987	68	37	1024	0	0	
6 AM	1858	133	137	1995	1718	122	117	1834	0	0	
7 AM	3819	297	629	4449	3348	255	474	3822	528	93	
8 AM	6150	531	1814	7964	3942	308	674	4616	1204	212	
9 AM	9913	1044	5751	15665	7390	678	2785	10175	5929	1046	
10 AM	13080	1692	12292	25373	9933	1048	5781	15714	10637	1877	
11 AM	14590	2116	17152	31741	11888	1416	9352	21240	15334	2706	
12 PM	14791	2181	17919	32710	12428	1535	10600	23029	16854	2974	
1 PM	15654	2484	21599	37253	12063	1454	9741	21804	15814	2791	
2 PM	15273	2344	19892	35165	11515	1338	8562	20077	14346	2532	
3 PM	15432	2401	20587	36019	11316	1299	8164	19480	13838	2442	
4 PM	15790	2536	22242	38033	11050	1247	7656	18706	13180	2326	
5 PM	14892	2214	18316	33208	9929	1047	5775	15705	10629	1876	
6 PM	12885	1643	11763	24648	10089	1074	6020	16109	10973	1936	
7 PM	10503	1146	6688	17191	8120	774	3492	11611	7150	1262	
8 PM	7994	757	3362	11357	6438	564	2016	8454	4466	788	
9 PM	5276	437	1282	6558	4885	398	1079	5963	2349	415	
10 PM	3508	269	524	4032	3267	248	450	3717	439	78	
11 PM	1327	93	69	1396	1974	142	156	2129	0	0	

Base Q = queue formed after 30 minutes (gates closed to gates open)

added t = time for queue discharge wave to reach the back of the growing queue

added Q = additional queue length formed until the wave reaches the back

Total Q = Base Q + added Q

Q to S = westbound queue split extending to the southwest on SR-3

Q to N = westbound queue split extending to the northeast on SR-104

Note: a westbound Total Q under 3200 feet does not extend past the SR3/SR104 intersection

										o GROWTH																				
	LUME	2010 UNITS	610	280		6400	7500	13000	13000	16000+ 2	6000	5600	5500+	6700	16000	12000	11000	7900	4000	4000	4300	2900*	5900*	6800	4100	10000	9600	9600	17000	ы С
	RAFFIC VO	2009 UNITS	610	280		6400	7600	13000	13000	16000*	5700*	5300*	5300*	6400	15000	12000	11000*	7800	4000	4000	4300	2900*	5800*	6800	4000	10000	9500	9500	18000	COUNT PERCENTAG
	SE DAILY T	2008 UNITS	570*	260*		6200*	7300*	13000*	13000*	16000*	5900	5500	5600*	6700*	15000*	12000*	10000*	+0022	4000*	*0068	4200*	2900*	5800*	6800*	4000*	¥0086	9400*	9400*	17000	NN ACTUAL OF TRUCK
	AVERAC	2007 UNITS	510	230		6400	8100	13000	13000	16000*	6500	6000	6100*	7300	16000				4200	4100	4600	3000*	6200*	7400	4400	10000	10000	10000	19000*	* BASED (+ SOURCE
STATE OF WASHINGTON - DEPARTMENT OF TRANSPORTATION T R I P S S Y S T E M ANNUAL TRAFFIC REPORT		TRUCK PERCENTAGES SNGL DBL TRIPLE TOTAL								06 03 09			06 01 08																	
		INCT LASS	т	ю	PRK	щ		ч	1			ы		,1	ы	1		гH		н,	Ч	Ч	H,		ب		÷۲	-	Ч	
		ST LOCATION COUPLET CI	5 BEFORE JCT OYSTERVILLE RD	5 AFTER JCT OYSTERVILLE RD	ROUTE NO 104 MAINLINE SR 101 TO SR 522/L F	1 AFTER JCT SR 104 W BND	7 BEFORE JCT SR 19-BEAVER VALLEY RD	7 AFTER JCT SR 19-BEAVER VALLEY RD	6 BEFORE JCT PARADISE BAY RD*SHINE RD	2 AT PTR LOCATION R085	9 AFTER JCT SR 104 WYE CONN	1 BEFORE JCT GAMBLE WAY	8 AT PTR LOCATION R095	8 BEFORE JCT SR 307	8 AFTER JCT SR 307	6 BEFORE JCT PARCELL RD WYE CONN	2 AFTER JCT BARBER CUTOFF RD WYE CONN	O AFTER JCT W 1ST ST NE	3 AFTER JCT SR 104 COKNGSTN (COUPLT) C	2 BEFORE JCT KINGSTON RD*IOWA AVE C	2 AFTER JCT KINGSTON RD*IOWA AVE C	3B KINGSTON FERRY LANDING	5 EDMONDS FERRY LANDING	0 BEFORE JCT SR 104 E BND WYE CONN	1 AFTER JCT SR 524*SUNSET AVE	2 BEFORE JCT PINE ST WYE CONN	5 AFTER JCT SR 524 SPUR WYE CONN	5 BEFORE JCT FIFTH ST	0 AFTER JCT SR 104 W BND	ET SKETCH IN BACK OF BOOK
	む日本住の	ROUTE MILEPOS	016.25	016.25	STATE F	000.41	008.87	008.87	013.76	013.92	015.55	016.51	019.48	020.58	020.58	023.06	023.12	024.10	** 024.23	024.32	024.32	024.53	024.45	024.50	024.51	025.12	025.15	025.55	025.70	** COUPLE
		STATE ROUTE	103	103		104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	